THE SMARIDIDAE (ACARINA) OF NORTH AND CENTRAL AMERICA AND SOME OTHER COUNTRIES

by R. V. Southcott

[Read 10 May 1962]

SUMMARY

The Smarididae of North and Central America are reviewed and redescribed from various collections, and some Smarididae from other countries are referred to, where they throw further light on the American forms.

The following species are described or redescribed for the adult (and in some cases the nymph): *Smaris zeteki*, sp. nov., *S. lanceolata*, sp. nov., *S. grandjeani* (Oudemans, 1941), f.p., *S. grandjeani* subsp. *christensoni*, subsp. nov., *S. boneti*, sp. nov., *Calorema*, gen. nov., *C. azteka*, sp. nov., *Fessonia serrata*, sp. nov., *F. australiensis* Southcott, 1946 (including North American, Asian and further Australian material), *F. lappacea*, sp. nov., *F. scobina*, sp. nov., *F. lacrimosa*, sp. nov., *Hirstiosoma bolivari*, sp. nov., *Trichosmaris* gen. nov., *T. dispar*, sp. nov., *T. dispar* subsp. *dentella*, subsp. nov., *T. jacoti* (Southcott, 1946), comb. nov., *Clavismaris*, gen. nov., *C. conifera*, sp. nov., *C. cybaea*, sp. nov.

An attempt is made to evaluate the systematics of smaridid mites previously described from North and Central America. The genus *Leuchsia* Oudemans, December, 1941, is shown to be a synonym of *Smaris* (Latreille) Womersley and Southcott, July, 1941.

The structure of the smaridid dorsal idiosomal seta (scobala) is examined and a terminology proposed for its various parts.

Comment is made upon mounting media used in the study of the Smarididae. It is recommended the use of media containing polyvinyl alcohol be abandoned.

I. INTRODUCTION

Few previous studies have been made of the smaridid mite fauna of North and Central America. Up to the present time the only smaridids recognizable as such recorded for this area are:

(1) *Smaris longilinealis* Ewing, 1909. Ewing's account is insufficient for the generic placing of this mite with any certainty. The possibility that this species is a synonym of *Trichosmaris dispar*, sp. nov., of the present paper is discussed later.

(2) *Smaris longilinealis* Ewing, 1910. This mite is also not generically placeable from the information given by Ewing. It is very unlikely that this species is conspecific with *Smaris longilinealis* Ewing, 1909, and it is probably not congeneric with it. This subject is discussed further in the text.

(3) *Hirstiosoma jacoti* Southcott, 1946, proposed as a new name for *Smaris sericea* Jacot, 1938, non *Trombidium sericeum* Say, 1821. The lectotype is selected in the present paper and the species renamed *Trichosmaris jacoti*, comb. nov. The species is possibly a synonym of *Trichosmaris dispar*, sp. nov. This is discussed further in the text.

(4) *Smaris* sp. Jacot, 1938, p. 125. This species is distinct from the preceding, as Jacot realized. It was placed by Womersley and Southcott (1941, pp. 63, 78) in *Hirstiosoma*, but with the erection of further genera in the Hirstiosomatinae its generic placing is now uncertain. The possibility that this species is conspecific with *Clavismaris cybaea*, sp. nov., is discussed later.

(5) *Leuchsia grandjeani* Oudemans, 1941. This species was referred to earlier by the writer (1961a, p. 434) as belonging probably to *Smaris*. In the present paper the species is redescribed from specimens forwarded from America, and *Leuchsia* is placed confidently as a junior synonym of *Smaris*.

(6) *Smaris mamillatus* Baker and Wharton, 1952. This species was correctly placed generically by these authors; the good figure given is sufficient for generic identification. Possibly the species figured is the female of *Smaris lanceolata*, sp. nov., described from the male in the present paper. The specific name *mamillatus* (of Say, 1821) is not usable, being now allotted to a species of *Labidostomma* (see Southcott, 1961a, p. 573) (see also the remarks under *S. lanceolata*, and in Section IV).

The primary object of the present paper is a systematic study of the smaridid mites of North and Central America. It has been found desirable, however, to extend the study to a small amount of additional material from other countries. The study originated from a request from the United States National Museum, Washington, for a systematic revision of their mounted collection of Smarididae. The collection sent for study consisted of 75 slides, and was received in 1948. It contained specimens originating as early as 1905, and included material collected in the United States by E. A. McGregor, H. E. Ewing and others. The major part of the collection was, however, made up of mites received from the Plant Quarantine Service of the United States, which had been intercepted at stations on the United States-Mexico border or at shipping ports in the United States. Much of it had originated in Mexico, and other material came from various countries of Central America. In addition there was a small number of slides of specimens (*Fessonia australiensis* Southcott, 1946) from Hawaii, taken on plants originating in China, one specimen taken at Boston from India (same species), and one specimen taken at New York on onions coming from Europe (*Clavismaris cybaea*, sp. nov.). In view of the long life history of these mites, and the lack of information on whether any fumigation was done to the containers from which these mites originated, between ship voyages, there is no certainty that these mites did actually originate in the same country as that from which the plants came; such material should be treated with caution as far as attributing localities to species is concerned. Thus it is thought likely, on distributional grounds, that the smaridid mite taken upon the onions from Europe originated in North America. Despite these reservations the material received from these sources is of interest, and repays study. This group of 75 slides has been allotted identification numbers ACA 1642-1716.*

A further slide of a smaridid mite was received from the United States National Museum, following a request from the author for information about the type specimen of *Smaris longilinealis* Ewing. That specimen was labelled

*The author has used these numbers and prefixes to identify mites in his own collection: ACA 1, ACA 2, . . . for mites of the superfamily Erythraeoidea; ACB 1, ACB 2, etc., for mites of the family Trombidiidae (s.l.); ACC 1, ACC 2, etc., for mites of other groups. This system has also been extended to provide identification numbers of mites of the same groups referred to him for identification, even though the mites are not retained in his own collection. Frequently such mites are referred for identification in slide mounts without identification numbers, or may be received unmounted, then usually without such numbers.

"Cotype", and has U.S.N.M. Serial Number of 20231 (ACA 1752 of the author). It is not the holotype, and cannot be designated a lectotype as it did not come from the topotype area; it has in fact little nomenclatorial significance (see later).

The author has also had available for study a collection of 10 slides from the collection of the South Australian Museum, mostly of material collected in Mexico by F. Bonet, and mounted by Mr. H. Womersley or the author. These slides have identification numbers ACA 1717-1723, 1731A, 1731B and ACA 1731C, D.

A few slides in these two collections are not in a state which permits identification, mainly from over-treatment by potashing or from inadequate clearing in polyvinyl alcohol media.

In addition, in 1958 Mr. W. F. Rapp, Jr., entomologist, Department of Health, State of Nebraska, United States of America, submitted seven slides of smaridid mites collected in Nebraska and Texas. These have been allotted identification numbers ACA 1724-1730.

The present study has resulted in the description of three new genera and thirteen new species or subspecies, and extends the known range of the two previously described and recognizable species—*Smaris grandjeani* (Oudemans, 1941) and *Fessonia australiensis* Southcott, 1946—considerably. The latter species was originally described from the Northern Territory of Australia; in the present paper it is recorded from the Asian mainland and Mexico, as well as from Queensland, Australia.

For the descriptive terms used in the present paper, as well as the definitions of the previously described genera of the Smarididae, the author's monograph on the Erythraeoidea (1961*a*) should be consulted.

II. A NOTE ON THE STRUCTURE OF THE SMARIDID DORSAL IDIOSOMAL SETA AND ITS TERMINOLOGY

The smaridid dorsal idiosomal seta is typically a complex structure, though variable between species, and as its form will be used as an important determinant in systematics it has been found necessary to refer to its parts with somewhat more precision than has previously been customary. Certain new terms will be introduced here, additional to those used for setae by the author (1961*a*).

The seta (scobala) consists of a pedicle (*pedicellus*) and an expanded part, the *scobillum* (see Fig. 1). The pedicle has a bulbous proximal end which articulates in a socket in a chitinized epidermal structure, the *amphora*. The amphora has a cavity for the nerve supply, which responds to pressure changes resulting from movement of the seta, e.g. from touch, transmitted to the bulb of the pedicle. Usually the bulb of the pedicle is surrounded by a flat chitinized ring, the projecting part of the amphora, the *annulus* or seta base. This in smaridids (and other mites) is often set in a *seta fossa* in the skin. In certain smaridids with large setae the amphora may take the form of an enlarged chitinized papilla rising above the surface of the skin; this is, for example, the case in *Trichosmaris dispar* gen. nov., sp. nov., where the annulus becomes an invaginated cone set within the papilla (see Fig. 31K, L).

The scobillum has an external or dorsal (in the case of the dorsal setae) surface, the *tectum setae* or *tectum scobilli*, provided with a number of pro-

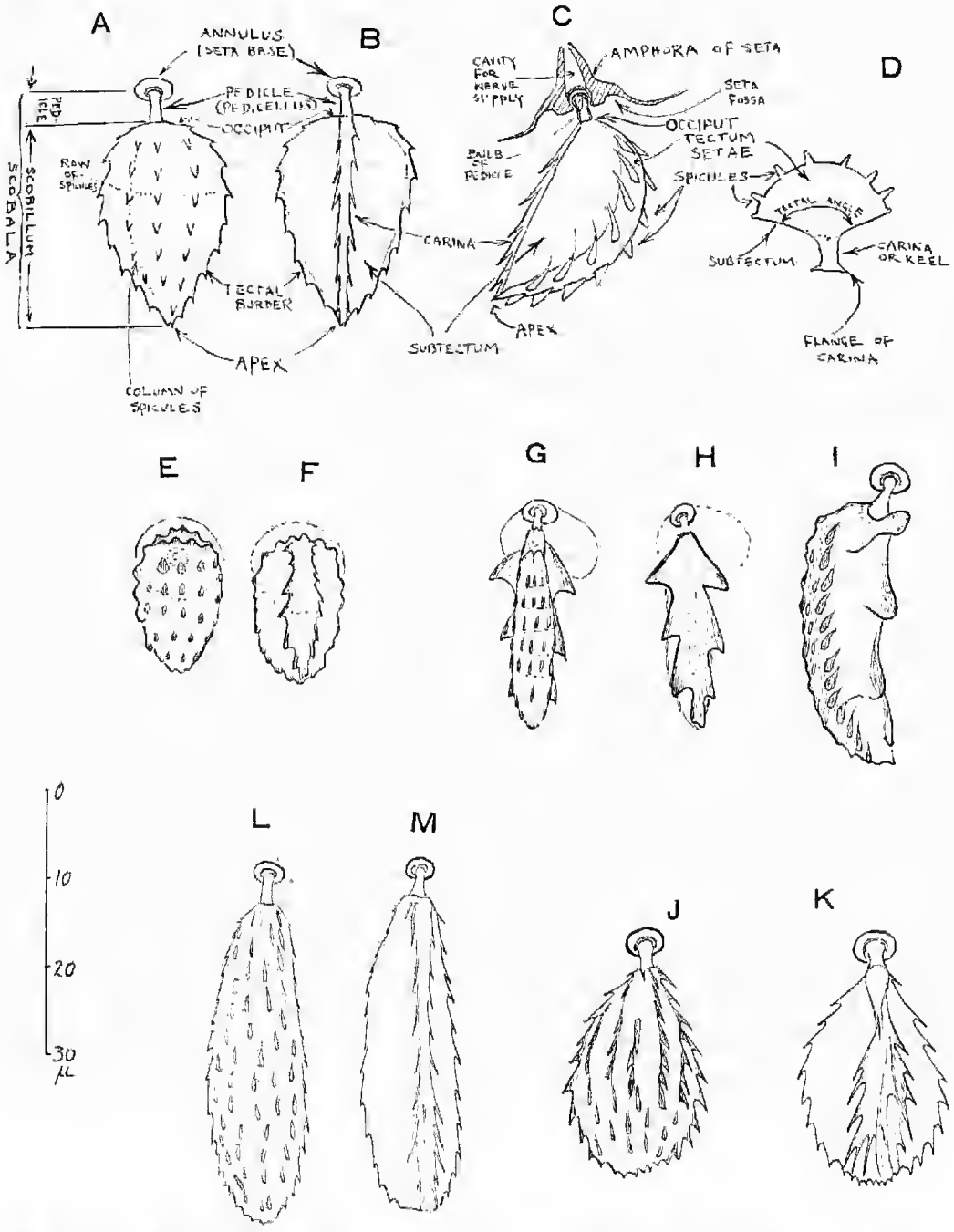

Fig. 1. Smaridid dorsal idiosomal setae (idiosomalae ; scobalae). A-D diagrams to explain structure: A, from above; B, from below; C, from side, partly in section; D, cross-section. E-M idiosomalae of various smaridid mites, to scale on left: E, F, *Smaris prominens* (Banks, 1916) (Australian, specimen ACA 441, South Australia, author's collection), E, from above; F, from below. G-I, *Smaris cooperi* Southcott, 1961 (Australian, holotype specimen, Kangaroo Island, South Australia), G, from above; H, from below; I, another seta in side view. J, K, *Fessonia australiensis* Southcott, 1946 (Australia, holotype specimen), J, from above; K, from below. L, M, *Fessonia lacrimosa*, sp. nov. (Mexico, holotype specimen), L, from above; M, from below. (Figs. E-I, to scale shown.)

jections, the spicules or modified ciliations. The tectum is most frequently convex, but may be concave or canoe-like, prismatic or irregular. Laterally it is bounded by the tectal borders, which run from the *occiput* or proximal part of the scobillum to the *apex* or distal point. On the internal or ventral surface of the scobillum is a *keel* or *carina*, which may be narrow, or at times partly swollen, and may be expanded into a distinct flange on each side. The carina is usually provided with ciliations or spicules, which may become large and prominent (see e.g. Fig. 1G-I). The area between the tectal margins and the carina is the *subtectum*. The two planes of the subtectum meet, on production, to form the *tectal angle* (Fig. 1D). The tectal spicules may be arranged in *columns* or *rows*, in some species the arrangement being regular, and in others more or less irregular, and in some cases the arrangement is partly regular and partly irregular (see Fig. 1).

Most of the preceding is a systematizing of terms already in existence, or an extension of them. The scobillum does not appear to have had a formal name applied to it previously, but was referred to by Grandjean (1935, p. 6) as the "couche externe" of the seta, which surrounds in his concept a colourless "axe de chitine", which includes the pedicle (pedicellus).

III. SYSTEMATIC PART

Subfamily SMARIDINAE Southcott (expanded)

(Synonymy as in Southcott, 1961*a*, p. 438)

Genus SMARIS Latreille

Restricted by Womersley and Southcott (1941)

For synonymy see Southcott 1961*a*, p. 438, and in addition, *Smaris* Southcott, 1961*b*, p. 133.

For definition and a discussion on the type species see Southcott (1961*a*).

Key to the Species and Subspecies of Adults of the Genus *Smaris* in North and Central America.

1. Dorsal idiosomal setae of the middle of the posterior dorsal idiosomal shield elongate, three or four times as long as the other dorsal idiosomalae
S. zetcki, sp. nov.

Dorsal idiosomal setae of a more uniform character 2

2(1). Dorsal idiosomal setae lanceolate, the tectum almost nude, with a few faint rows of spicules on the tectum setae and outlining the tectal borders
S. lanceolata, sp. nov.

Dorsal idiosomal setae otherwise 3

3(2). Dorsal idiosomal setae to 16μ long, pointed at apex, the tectum setae provided with rows of short, sharp spicules
S. grandjeani (Oudemans, 1941), f.p.

Dorsal idiosomal setae similar, to 22μ long
S. grandjeani subsp. *christensoni* subsp. nov.

Dorsal idiosomal setae to 30μ long, blunted and rounded at apex, with rounded tectal spicules
S. boneti, sp. nov.

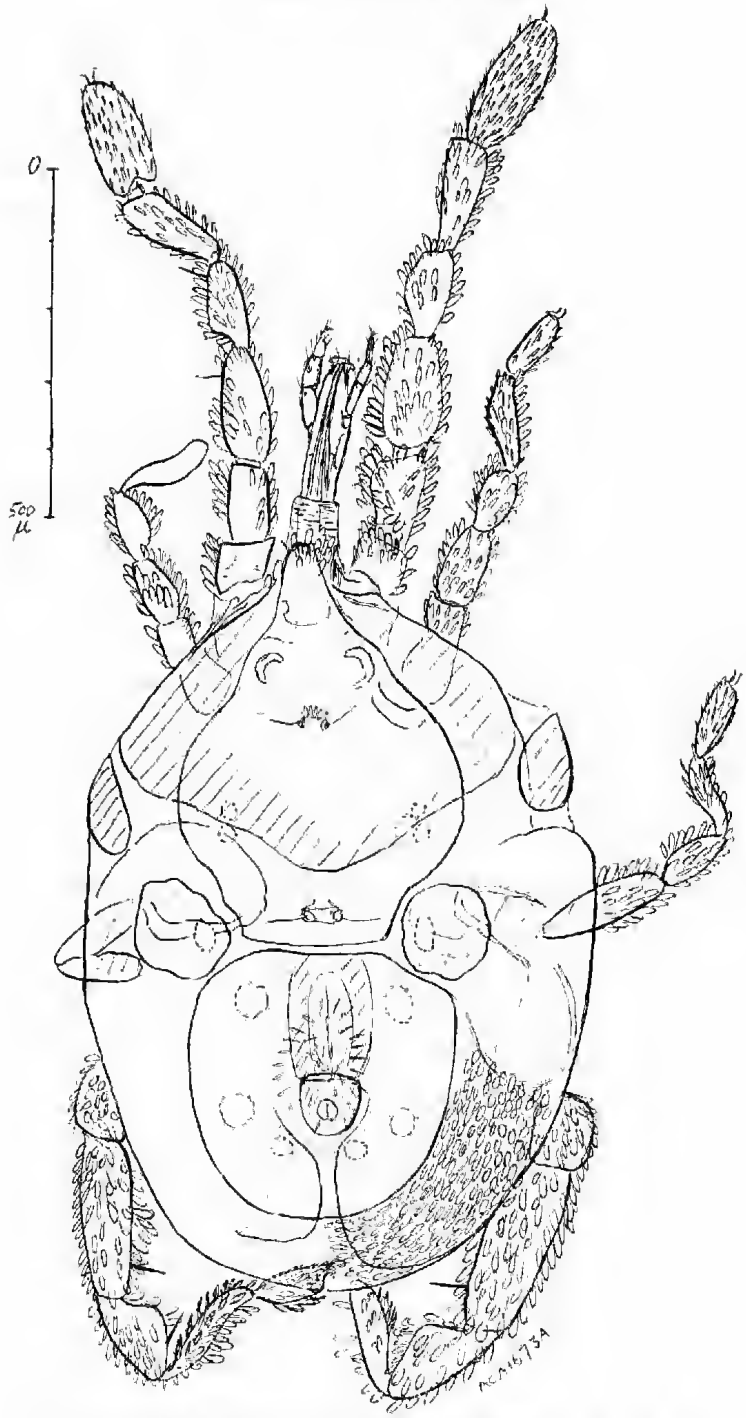

Fig. 2. *Smaris zeteki*, sp. nov. Adult female (holotype). View of mount of entire animal, somewhat compressed, shown mainly as from the dorsal aspect, but also to some extent in transparency, to show some ventral structure of idiosoma; setae mostly omitted, ventral structures shaded; broken lines outline asetose areas of dorsal shields.

Smaris zeteki sp. nov.

Figs. 2-4

Description of Adult Female (from Holotype ACA 1673A).

Colour in life not recorded. Animal of normal smaridid shape, fairly robust, with a short nasus, and with heavily sclerotized plates. Idiosoma 1045μ long to tip of nasus, by about 650μ wide where widest.

Anterior dorsal scutum present, 575μ long by 382μ wide, enclosing the sensillary areas and eyes, and extending forward to cover the nasus; this scutum is roughly pyriform, but with the edge somewhat irregular, and with ocular projections, it is flattened posteriorly where its edge almost abuts the anterior edge of the posterior dorsal scutum.

Eyes 2 + 2, each lateral pair conjoined upon a sessile sclerotized tuberosity. Anterior eye the larger, cornea 34μ across, and directed anterolaterally; posterior eye smaller, with cornea 24μ across, and directed posterolaterally. Each lateral eye tuberosity placed fairly close to the anterolateral border of the scutum which projects there to form the "ocular projection" of the scutum. Anterior sensillary boss wide, carrying the two anterior sensillae plus a number of large scobalae, as figured. Posterior sensillary boss as figured. Anterior and posterior sensillae filiform, ciliated, the ciliations longer terminally. There is some indication of a narrow pathway between the scobalae of the anterior dorsal scutum, outlining a "crista" between the anterior and posterior sensillae. Each scobala (ordinary seta) of the anterior dorsal scutum originates in the base or side of a deep pit in the scutum, these pits thus giving the anterior dorsal scutum a cribriform appearance. Upon the anterior dorsal scutum are two pairs of laterally placed asetose areas, set close together, as figured (see Fig. 2); the anterior of each pair about 20μ across and equivalent in space to about that occupied by one scobala, the posterior about 30μ across and equivalent in space to 4-5 scobalae.

The standard data (see Southcott, 1961*a*) for the two specimens studied are:

	ASens	PSens	SBa	SBp	ISD	DS
Holotype ACA 1673A	90	ca. 90	55	26	250	42-56
Paratype ACA 1673B	94	98	62	29	236	42-54

Posterior dorsal scutum large, oval but with flattened margins giving it a somewhat square appearance, 400μ long by 380μ wide. The anterior margin of the posterior dorsal scutum comes close to the posterior margin of the anterior dorsal scutum. Posterior scutum with 6 asetose areas of moderate size (up to 30μ across), as figured (Fig. 2). The setae of the posterior scutum are in its peripheral part similar to the adjoining dorsal idiosomal scobalae, being pyriform to lanceolate in outline (rather like the segment of an orange), pointed apically but flattened below, and with 4-5 columns of spicules in 6-8 rows; setae 18-22μ long by 6-10μ wide. In the centre of the posterior dorsal scutum the scobalae are considerably elongated, being lanceolate and clavate and in general are 50-56μ long by 2·5-5μ wide.

Two smaller mid-dorsal shields are present, irregularly oval, 135μ long by 108μ wide, and occupy the angles formed by the separating margins of the anterior and posterior dorsal scuta on each side. These mid-dorsal shields have,

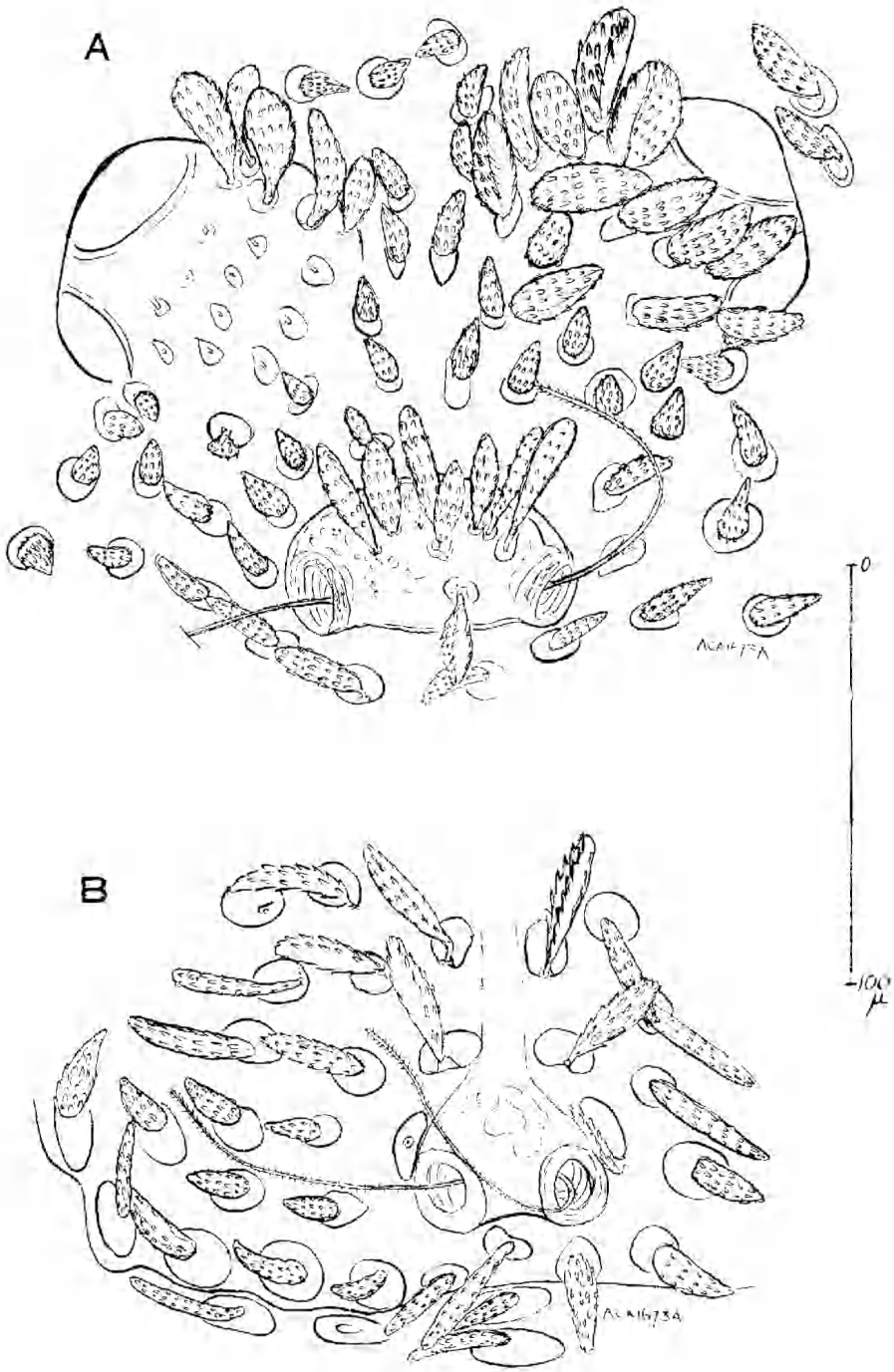

Fig. 3. *Smaris zeteki*, sp. nov. Adult female (holotype). A, anterior sensillary area and eyes; B, posterior sensillary area and surrounding structures (both to scale shown).

particularly on their lateral sides, an irregular undulating edge, each wave going around a seta-socket. These shields carry normal dorsal idiosomal scobalae, but each shield has a small asetose area about 50μ long by about 20μ wide, in its medial part.

The remainder of the dorsum of the idiosoma carries a large number of setae, each seta being set individually in a small sclerotized plate, which may be irregularly oval, reniform or ovoid, and measure roughly 16-26μ long by 12-14μ wide. These are thickly set upon the flexible skin of the idiosoma, and particularly posterolaterally upon the idiosoma are so heavily packed together that they tend to overlap each other, in the mounted specimen. Each seta plate has a thickened margin and a central depression in which the seta takes origin.

Ventral surface of idiosoma: The anterior part of the venter is covered by the normal anterior ventral plate of *Smaris*, enclosing coxae I and II of each side; this plate is heavily sclerotized. At its posterolateral margins are the two large oval anteroventral accessory plates, placed nearly at the lateral edge of the animal in dorsal view; these measure about 130μ long by 50-60μ wide. On each side the coxa III and IV are fused and set in a large posterolateral ventral plate, which extends anteriorly about 80μ in front of the anterior edge of coxa III, this anterior projection lying behind the anteroventral accessory plate and the lateral part of the anteroventral plate.

External genitalia set in a large genital plate as figured. Anus set in the posterior part of the anal plate, which is ovoid, with flattened anterior and lateral margins, 94μ long by 80μ across. The anterior edge of the anal plate approximates the posterior edge of the genital plate. The genital and anal plates are set in the midline between the paired posterolateral ventral plates of the idiosoma.

Legs somewhat irregular when seen in lateral view; heavily sclerotized. Leg lengths (trochanter to tips of tarsal claws): I 810μ, II 590μ, III 580μ, IV 820μ. Tarsus I 170μ long by 79μ high, tibia I 175μ long by 62μ high, genu I 148μ long, tarsus II 101μ long by 34μ high (a little oblique), tibia II 136μ long, tarsus IV 120μ long by 45μ high, tibia IV 185μ long, genu IV 168μ long (tarsal lengths exclude claws and pedicle). Tarsi with conical spiculate setae (scobalae) interspersed among the sensalae (solenoidalae). Tarsal claws ciliated obliquely along their sides in the proximal two-thirds. The scobalae of the tarsi and the dorsum of tibiae conical, pointed, with regular pointed spicules, rather like a pine cone. Other leg scobalae in general similar to usual idiosomal scobalae. The legs carry also various specialized sensalae (sensory setae). Specialized scobalae are also present in the form of pointed and ciliated tactulae upon the ventral distal parts (one per segment) of the telofemora and genua.

Gnathosoma as figured. Palpal scobalae simple or lightly ciliated.

Locality. This species is known from two specimens only, with identification numbers ACA 1673A (Holotype ♀) and ACA 1673B (Paratype ♀), Barro Colo[rado] Island, Canal Zone, Oct.-Nov., 1941, J. Zetek, slide labelled also Z-4915. Lot 42-8741. Holotype in collection of United States National Museum; paratype in South Australian Museum, ex U.S.N.M.

Remarks. (1) *Smaris zeteki* is quite a distinct species; the author knows of no other *Smaris* which has a similar elongation of a group of dorsal idiosomal scobalae. The species is dedicated to its original collector.

(2) The Holotype and Paratype specimens were on receipt mounted and heavily overstained with some pink dye. They have now been remounted and destained as far as possible without undue damage. They remain still fairly heavily stained, but are in a state fit for description of all features of taxonomic significance. The lack of clarity of the ventral plates in the mounts with dorsum-uppermost is due to this residual overstaining.

(3) It is of interest to note that the external genitalia and anus are each surrounded by a large sclerotized plate, within which the lips of the vulva and anus articulate. A somewhat similar feature was figured by Berlese (1894) (A.M.S. 71, 4, Fig. 2) for S. *squamata* Berlese, 1883, and which Grandjean (1947, p. 53) doubted (see also the comment by Southcott (1961*a*, p. 440)).

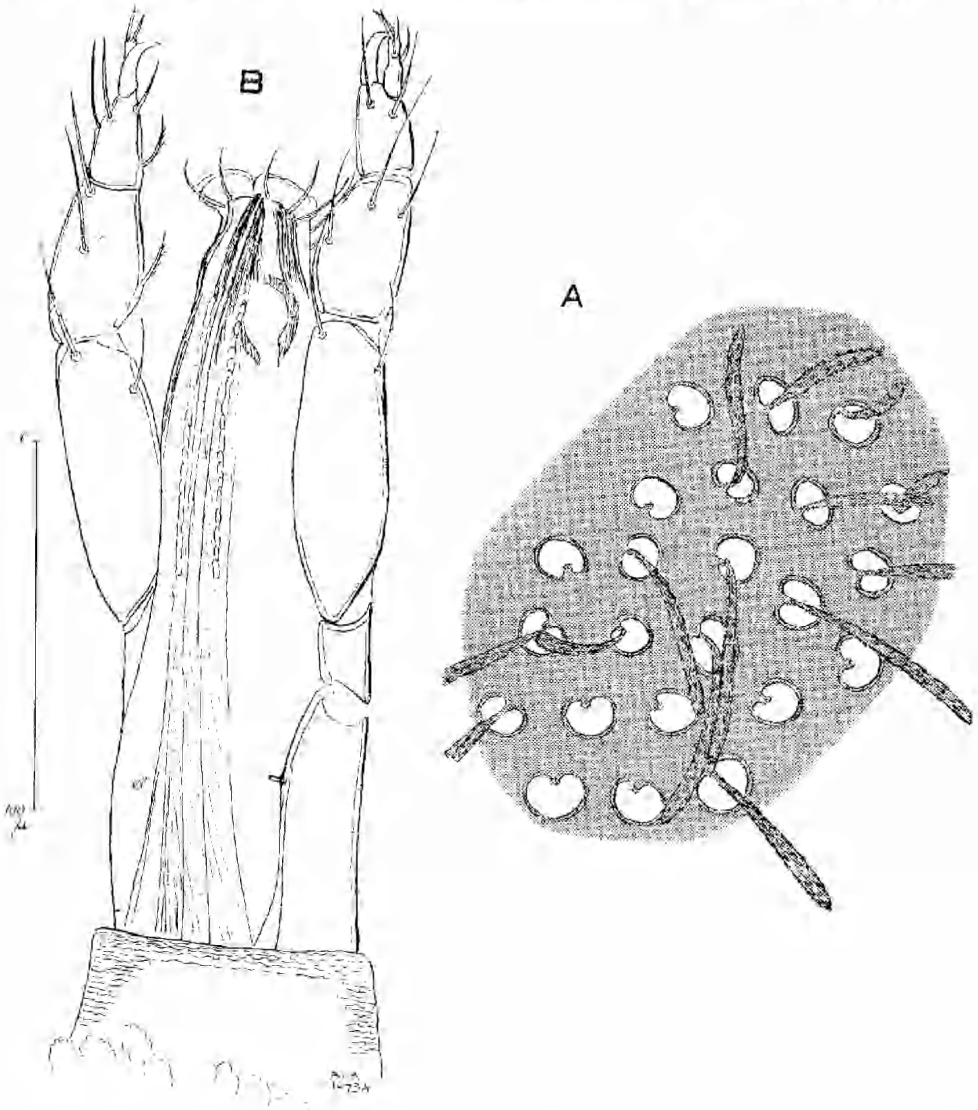

Fig. 4. *Smaris zeteki*, sp. nov. Adult female (holotype). A, central part of posterior dorsal scutum to show setae and seta-pits; B, mouthparts, dorsal aspect (to same scale).

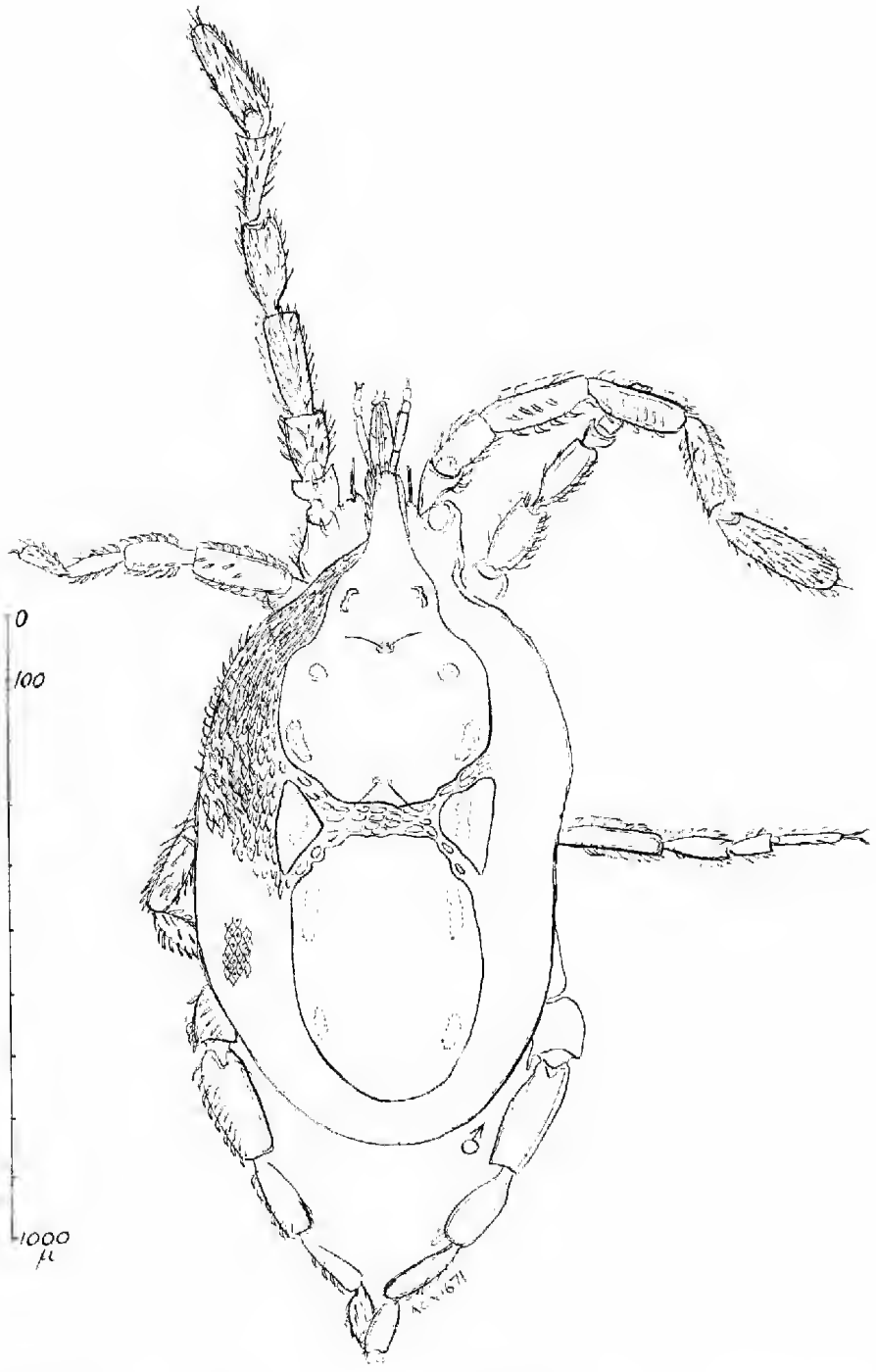

Fig. 5. *Smaris lanceolata*, sp. nov. Adult male (holotype), dorsal aspect, setae mostly omitted.

Smaris lanceolata sp. nov.

Figs. 5-7

†*Smaris mamillatus* Baker and Wharton, 1952, p. 242, Fig. 179.

Description of Adult Male (from Holotype ACA 1671).

Colour in life not recorded. Animal of normal smaridid shape, somewhat slender, with a narrow nasus of moderate length. Idiosomal plates lightly sclerotized. Idiosoma 1020μ long to tip of nasus, 540μ wide where widest.

Anterior dorsal scutum present, 510μ long by 304μ wide, enclosing the sensillary areas and eyes. The scutum is irregularly pyriform, but with well-marked ocular projections on the lateral margins, and the posterior margin is flattened.

Eyes 2 + 2, each lateral pair forming a conjoined indented tubercle, moderately sclerotized. Anterior eye the larger, placed somewhat medially to the posterior eye, and directed anterolaterally, with cornea 30μ across; posterior cornea directed laterally, and 24μ across. Each lateral pair of eyes is fairly close to the edge of the scutum, where there is a large ocular projection (see Fig. 5).

Anterior sensillary boss lightly sclerotized, and in addition to the two anterior sensillae it carries about 5 scobalae (in Paratype ACA 1719; uncertain in Holotype). The anterior sensillae ciliated, slightly clavate, as figured (Fig. 6A). The posterior sensillary boss as figured (Fig. 6B); the posterior sensillae of uniform thickness, ciliated.

The anterior dorsal scutum has no indication of any crista. It has four asetose areas, as figured (Fig. 5) for muscular insertions.

The standard data of the Holotype specimen are:

ASens	PSens	SBa	SBp	ISD	DS
36	41	30	19	208	20-22

Posterior dorsal scutum fairly large, an elongate oval, but flattened anteriorly and anterolaterally, 415μ long by 270μ wide. The anterior margin comes close to the posterior margin of the anterior dorsal scutum, the separation 40μ. Its scobalae are of uniform character, similar to those of the remainder of the dorsum of the idiosoma. There are 4 punctate areas practically or entirely devoid of setae on the anterior dorsal scutum, placed as figured (Fig. 5).

Two mid-dorsal shields are present, set in the angles between the anterior and posterior median dorsal shields; they are roughly triangular, 160μ long by 85μ wide, and are devoid of scobalae. In addition, they each have a central longitudinal punctate part as figured (Fig. 5).

Apart from the dorsal scuta the dorsum of the idiosoma is thickly beset with scobalae. These setae are in general lanceolate, sharply angled near their base, and almost devoid of ciliations. The leaf-like tectum setae is outlined by a thickened tectal border, and carries upon its surface three rows of projections or spicules, as figured (Figs. 6 A, B, 7 A-D). The spicules are weak and adnate, and appear as weak segmented columns rather than as outstanding serrations. Along the ventral surface of the scobala the keel forms a protuber-

ance near the occiput of the scobillum, the keel then expands fanwise distally. The scobalae of the dorsal shields are set in small fossae, and each of these scobalae arises mostly toward the edge of the fossa. On the remainder of the dorsum of the idiosoma each scobala is set individually in a small oval or diamond-shaped shield, as figured (Figs. 6 B, 7 A-D). Each individual seta-shield has a central excavation in which the seta takes origin; the shields appear like small canoes or coracles, and are thickly packed together.

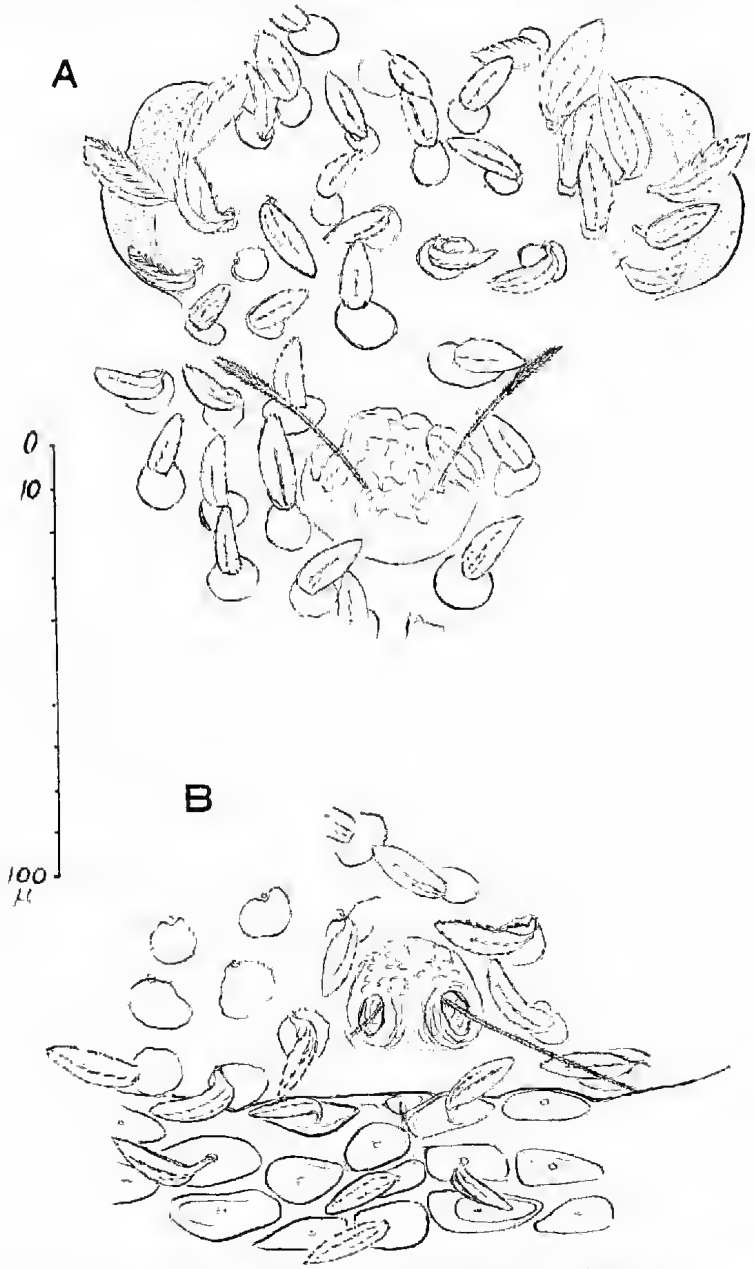

Fig. 6. *Smaris lanceolata*, sp. nov. Adult male (holotype). A, anterior sensillary area and eyes; B, posterior sensillary area and adjacent structures.

Scobalae of somewhat different character are found dorsally on the nasus at the tip and inferiorly to it; these setae are expanded and more rugose; the tectum setae carries up to 5 rows of finger-like projections arranged in regular columns and rows extending to the apex of the seta; the setae are thus large, fan-like, chitinized, 30μ long by 9μ wide.

Venter: the normal large anteroventral scutum is present, enclosing the the anterior coxae; there are no large anteroventral accessory plates. Each coxa III and IV of each side is fused as usual into a large posterolateral ventral coxal plate, lightly sclerotized, and with an anterior flange projecting well forward from coxa III.

External genitalia lightly sclerotized, the male labia majora being 167μ long by 72μ across with the lips in apposition. Flanking the external genitalia posterolaterally are two triangular adgenital plates, 210μ long by 67μ across, as figured (Fig. 7 E).

The anal plate is large, 126μ long by 146μ across, the anus set in the anterior part of it as figured, with spindle-shaped burr-like bushy setae ("analae") alongside. There are 4 posterior ventral plates as shown around the opisthosoma ventrally (Fig. 7 E).

The ventral scobalae are in general similar in character and size to those of the dorsum of the idiosoma. Those not arising from the larger ventral plates are set individually on small seta-plates as figured (Fig. 7 E), between the other plates.

Legs normal; leg lengths, including trochanter to tip of tarsal claws, I 870μ, II 530μ, III 540μ, IV 720μ. Tarsus I 190μ long by 55μ high, tibia I 200μ long, genu I 180μ long, tarsus II 88μ long by 43μ high, tibia II 115μ long, tarsus IV 97μ long by 41μ high, tibia IV 163μ long, genu IV 157μ long (tarsi measured exclusive of claws and pedicle). Tarsal claws lightly obliquely ciliated, except terminally. Tarsi with many scobalae, heavily ciliated with stiff pointed ciliations hence burr-like, pointed apically, angled basally, more rugose than the body setae but of somewhat similar character; setae of typically smaridid character. Various sensalae present among the scobalae of the legs, especially distally.

Gnathosoma as figured (see Fig. 7 F; also 5, 7 E); palpal scobalae lightly ciliated.

Locality. The following three specimens have been examined: ACA 1671, adult male (Holotype), under dead orange bark, La Campana, Panama, Sept. 28, 1938, J. Zetek, Number 4288. Lot 38-17223, U.S.N.M. In United States National Museum.

ACA 1672, one specimen, adult ? ♀, Paratype. On *Lycaste* sp., Canal Zone, at B'ville [= Brownsville, Texas, United State of America], April 29, 1946, Williamson-Allen, collectors. Brownsville 60882, Lot 46-5491. To be deposited in South Australian Museum ex United States National Museum.

ACA 1719, one specimen, Paratype. Miramar, Manzanilla, Mexico, January 16, 1943, F. Bonet, No. 692. This specimen is in poor condition, and its identification is a little dubious. In South Australian Museum collection.

Remarks. As indicated in the introduction of this paper, Baker and Wharton (1952, Fig. 179, p. 242) figured an adult female smaridid mite which they identified as *Smaris mamillatus* (Say). That specific name has, however, now been given to a species of *Labidostomma.*[6]

[6] Note added in proof: Atyeo and Crossley (1961) give reasons for proposing that *Labidostoma* is the correct spelling of the name *Labidostomma* Kramer, 1879.

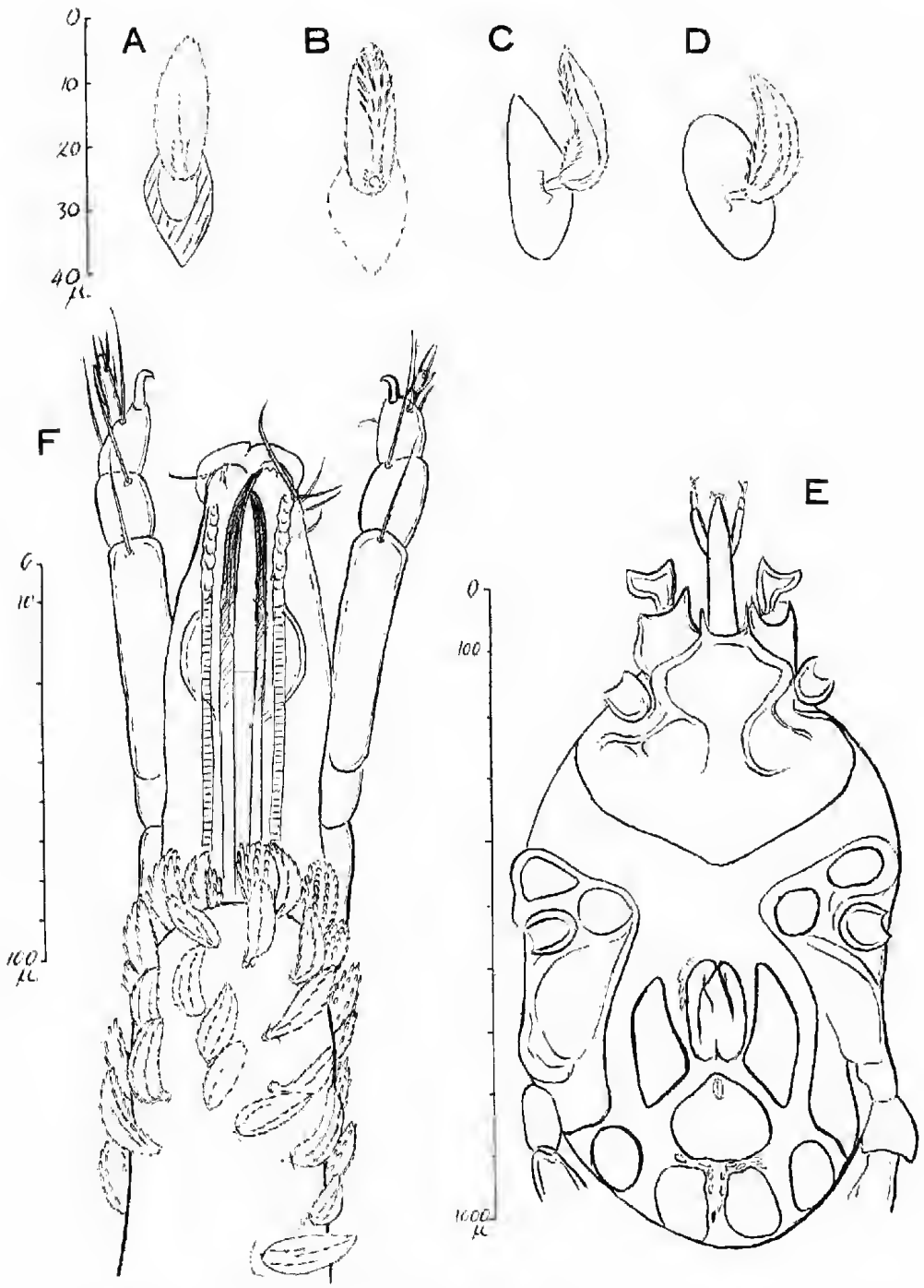

Fig. 7. *Smaris lanceolata*, sp. nov. Adult male (holotype). A-D, dorsal idiosomal setae, to scale on left. A, seta and seta plate, from left of middle of dorsum; B, same seta from below; C, D, setae from near posterior pole of idiosoma, seen in side view; E, ventral surface of idiosoma, to show shields, setae omitted; F, gnathosoma and tip of nasus from above.

The general appearance of Baker and Wharton's specimen is in agreement with *Smaris lanceolata*. The mid-dorsal shields lack setae, and the disposition of the asetose areas on the anterior dorsal and mid-dorsal shields is in agreement with the male *S. lanceolata*. The central setae of the posterior dorsal scutum are not lengthened. In the anterior half of the posterior dorsal scutum Baker and Wharton figure two small laterally placed asetose areas, and in the posterior half they show a curved row of four asetose areas. That arrangement appears to agree with the specimen ACA 1672 referred to above. As, however, specimen ACA 1672 is not ideal for description, it is thought best to leave the description of the female and the selection of an allotype specimen to the future. (It is not possible to identify Baker and Wharton's specimen with more precision as no detail of a dorsal scobala is given, etc. No locality data were given.)

Smaris grandjeani (Oudemans) f.p.

Figs. 8 and 9

Leuckia grandjeani Oudemans, 1941, p. 182.

Smaris grandjeani Southcott, 1961*a*, p. 434.

Redescription of Adult (from ACA 1674, Male)

Colour in life not recorded. Animal of normal smaridid shape, with a slender nasus of moderate length, and with the idiosoma provided with a number of sclerotized plates. Idiosoma 850μ long to tip of nasus, by 565μ wide where widest (the animal is somewhat compressed in the slide mount).

Anterior dorsal scutum as figured (Figs. 8, 9A), 460μ long by 280μ wide, enclosing the eyes and sensillary areas, and extending to the nasus. It is pyriform, widest posteriorly, and with its edge cut into undulations which accommodate adjacent seta-plates.

Eyes 2 + 2, normal, each lateral pair arising from a normal sclerotized ocular boss. Anterior eye the larger, cornea 28μ across, the eye directed anterolaterally; posterior eye with cornea 24μ across, directed posterolaterally. The ocular boss carries about 7 normal dorsal idiosomalae (scobalae). Each pair of eyes placed close to border of scutum, and there is a slight ocular projection upon the scutum's anterolateral border. Anterior sensillary boss present, only moderately sclerotized, carrying the 2 anterior sensillae plus 3 scobalae. Anterior sensillae slender, with minute ciliations throughout the proximal 2/3, the ciliations thereafter longer to form a slight enlargement at the end. Posterior sensillary boss fairly small, lightly sclerotized, and without scobalae (posterior sensillae missing in specimen ACA 1674).

The standard data of specimen ACA 1674 are:

ASens	PSens	SBa	SBp	ISD	DS
46	–	26	18	192	12-16

The scobalae of the anterior dorsal scutum originate individually from the side of a circular or irregular pit, thus giving the anterior scutum a cribriform appearance.

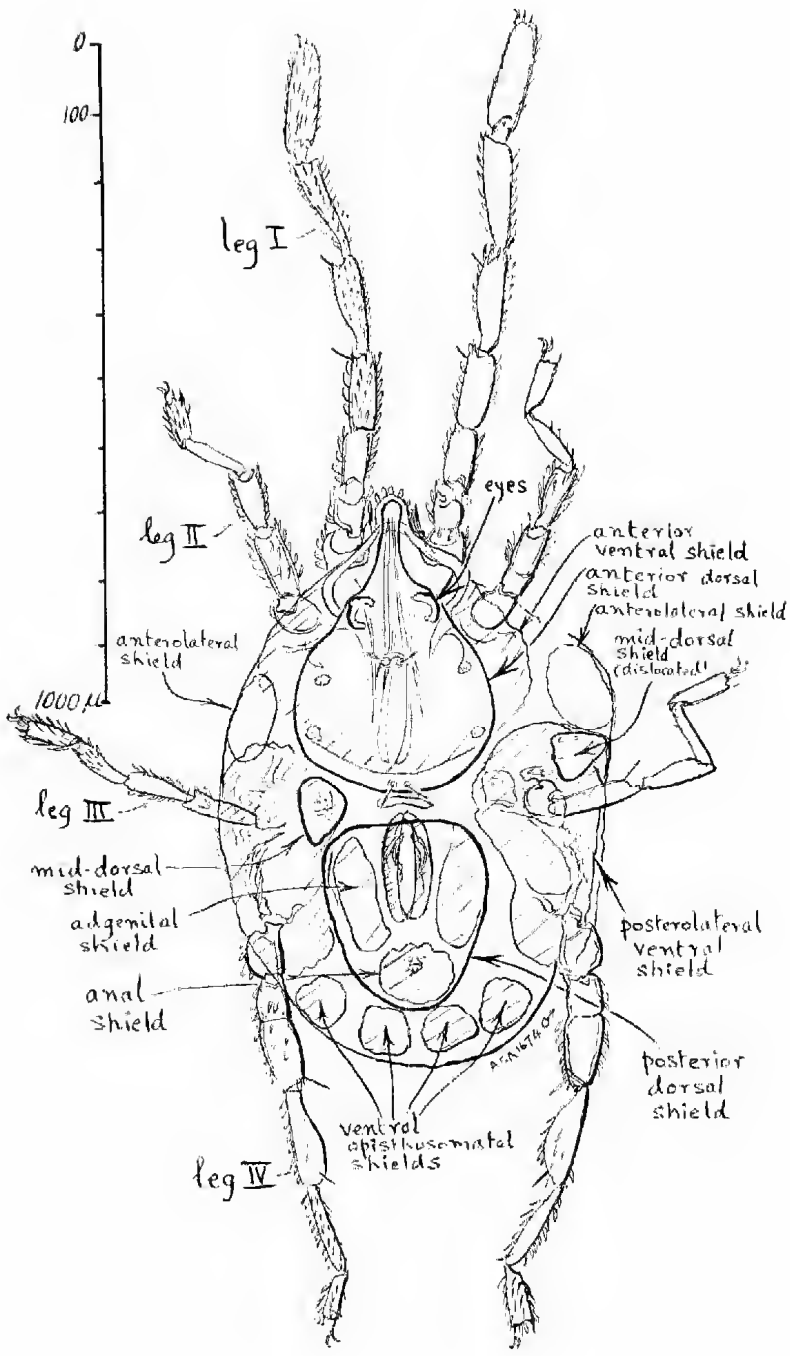

Fig. 8. *Smaris grandjeani* (Oudemans, 1941). Adult male, specimen ACA 1674, seen as a transparency, setae mostly omitted. Ventral structures shaded obliquely.

Posterior dorsal scutum large, widest anteriorly, a blunted triangle, with a somewhat sinuous edge. It is similar in structure to the anterior dorsal scutum, 281μ long by 258μ wide.

The idiosoma has other dorsal shields as figured (Fig. 8).

The dorsal idiosomal setae are typically smaridid in character, with a convex tectum and a tectal angle of about 120°; the tectum studded with short sharp spicules arranged fairly regularly in about 8 rows of 7-9 columns, except for the final 3 apical rows (see Fig. 9 A, B). The setae of the posterior part of the posterior dorsal scutum tend to be narrower than the others. Those idiosomal scobalae not arising on the larger shields arise individually in small polygonal seta-plates with excavated centres (Fig. 9 A, B). The dorsal idiosomal scobalae are in general less than twice as long as wide, the setae of the posterior part of the posterior dorsal scutum being an exception. A typical seta from near the posterior pole of the idiosoma dorsally, e.g. of Fig. 9 B, measure 14μ long by 10μ wide.

Venter with shields as figured (Fig. 8). The ventral idiosomalae are similar to the dorsal. Genitalia of specimen ACA 1674 of normal male smaridid character; adgenital shields are as figured. The anus is set in an anal shield as figured; the scobalae immediately adjacent to the anus are normal "analae" as described for other smaridids (pine-cone-like, with pointed spicules). Around the periphery of the opisthosoma in ventral view are 4 plates as figured; these are about equal in size, somewhat irregular, with rounded angles.

Legs fairly slender; leg lengths (including trochanter to tips of tarsal claws), I 765μ, II 470μ, III 470μ, IV 660μ. Tarsus I 173μ long by 52μ high; tibia I 180μ long, genu I 145μ long, tarsus II 76, 81μ long by 30μ high, tibia II 104μ long (left and right), tarsus IV 94μ long by 36μ high, tibia IV 150μ long, genu IV 153μ long (tarsal lengths exclude claws and pedicle). Tarsi with normal tarsal setation; tarsal claws ciliated along their sides, obliquely, except at tips. Scobopedalae of proximal segments similar to idiosomal scobalae but more elongate. Sensipedalae of normal smaridid type.

Gnathosoma appears normal, but as in ACA 1674 it is in the retracted position details cannot be clearly discerned.

Locality. The material referred to *Smaris grandjeani grandjeani* consists of three specimens:

One specimen, adult male, ACA 1674, in collection of United States National Museum, dated Nov., 1938, but without locality or other data, except details of slide mounting (2% KOH, acetic acid, absolute alcohol, clove oil, balsam).

Two adult specimens, serial ACA 1670, in collection of United States National Museum, the only data available being recorded on the slide as "Card No. 2961 . . . *Bufo* □ *georgea*", of which the significance is not known.

Remarks. The figures and description given above match the specimen described by Oudemans (1941) in all essential details. As Oudemans gave no metric data for his mite except the length and breadth of the animal (1·04 mm. x 0·45 mm.) and the length of leg I (0·87 mm.) the present author has given the usual data he now gives in describing smaridid mites. Oudemans did not describe the system of dorsal plates of his specimen, but the pattern of setae shown in his Fig. 1 gives some indication of their presence. His Figs. 4 and 5 show the sensillae, rather inadequately, and he was not able to observe the eyes at all. The ventral surface was, however, quite well figured (his Figs. 8-15) and shows the ventral idiosomal system of plates quite well (from which it is con-

cluded that Oudemans's specimen was described from a mite mounted with its venter upmost). However, Oudemans misinterpreted the relationships of the plates concerned with coxae III and IV, showing (Fig. 8) coxa III separated from IV, and showing also as separated the plates extending in front of coxa III and behind coxa IV. These are in *Smaris* all in continuity. The dorsal setae are not shown by Oudemans as pointed terminally (see his Figs. 1-7), but otherwise his figures show the general shape fairly well, and the setae on the nasus (his Fig. 3) are well drawn (compare with Fig. 9 A of the present paper).

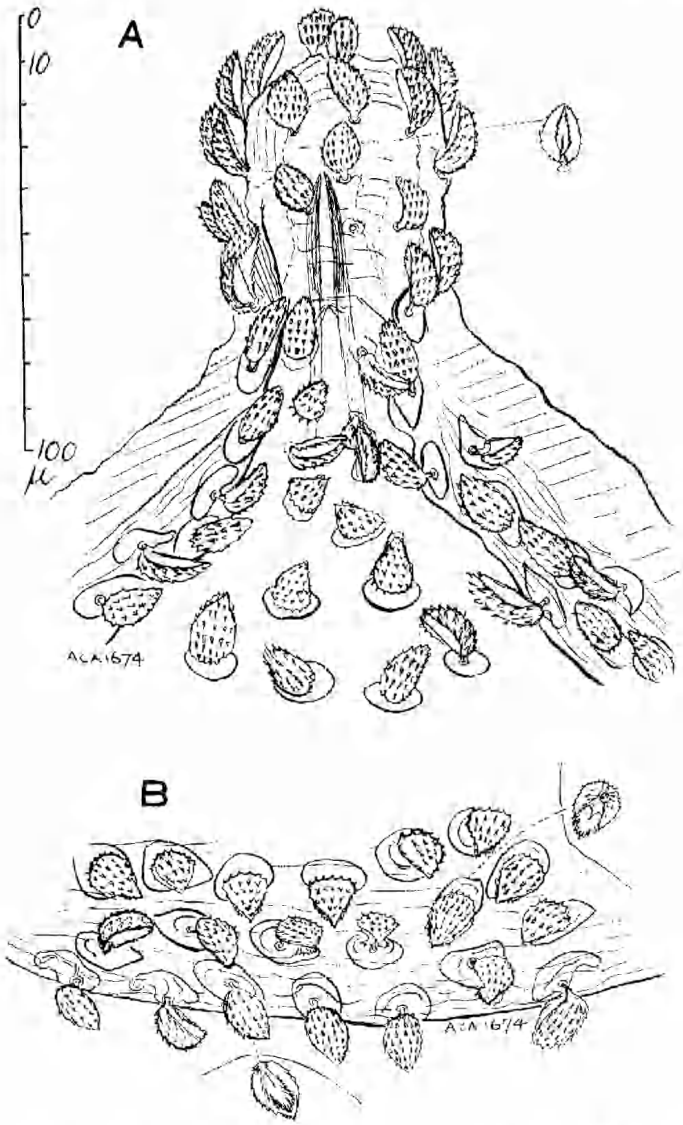

Fig. 9. *Smaris grandjeani* (Oudemans, 1941). Adult male, specimen ACA 1674. A, dorsal view of nasus and adjacent and underlying structures, showing also one scobala (inset) in ventral view. B, posterior pole of idiosoma, showing (inset) also ventral or carinal aspects of two scobalae. (All to scale shown.)

Oudemans stated that the following obtains with the leg lengths: I > II > IV > III. The present author, however, considers such a relationship unlikely to be correct in a smaridid mite, as leg IV is normally next in length after I. Reference to Oudemans's Fig. 2 shows that in the specimen described (the holotype) leg II is incomplete, and this would suggest that Oudemans estimated the length of leg II from the remaining parts rather than measured it in entirety, although he had actually two specimens available for study (the text does not state whether the second specimen was used in the description).

The only significant character in which *Leuchsia* was differentiated from *Smaris* by Oudemans lay in the fact that *Leuchsia* was alleged to possess "Keine Augen". The probable explanation for Oudemans's failing to recognize has been suggested above, apart from the deterioration of the standard of his work in that final paper of his career, which the author has commented upon elsewhere (1961*a*, p. 428).

The present author is satisfied with the identity of the material before him as conspecific with Oudemans's species. Oudemans stated, "Ich verdanke die 2 Exemplare dem Herrn F. Grandjean, der sie in moderndem Holze, August 1926, in der Umgebung von Colon, Panama, fand". It is to some extent regrettable that the slide mounts of the U.S.N.M. material do not carry more data. Presumably the specimens referred to originated in North or Central America.

From the above it may with confidence be concluded that *Leuchsia* Oudemans (December) 1941 is a junior synonym of *Smaris* (Latreille) Womersley and Southcott (July) 1941, as the author has provisionally indicated earlier (Southcott, 1961*a*, pp. 434, 435).

The holotype is in the Oudemans collection (not seen).

Smaris grandjeani subsp. **christensoni** subsp. nov.

Figs. 10 and 11

Description of Adult Male (from Holotype ACA 1667).

This subspecies is similar to the principal form of the species, but differs in having more elongate dorsal setae. These scobalae are, as Figs. 10 and 11 show, about twice as long as wide, or more.

The standard data of the holotype are:

ASens	PSens	SBa	SBp	ISD	DS
52	64	26	17	118	16-22

A typical measurement of a scobala near the posterior pole of the idiosoma, dorsally, is 18μ long by 8μ wide. The tectum setae has 5-8 (usually 5-6) columns of spicules in 7-8 rows.

Tarsus I is 128μ long by 78μ across, tibia I 135μ long, genu I 143μ long, tarsus II ca 90μ long by 41μ high, tibia II ca 100μ long, tarsus IV ca 95μ long by ca 40μ high, tibia IV ca 150μ long, genu IV ca 160μ long (tarsal lengths exclude claws and pedicle).

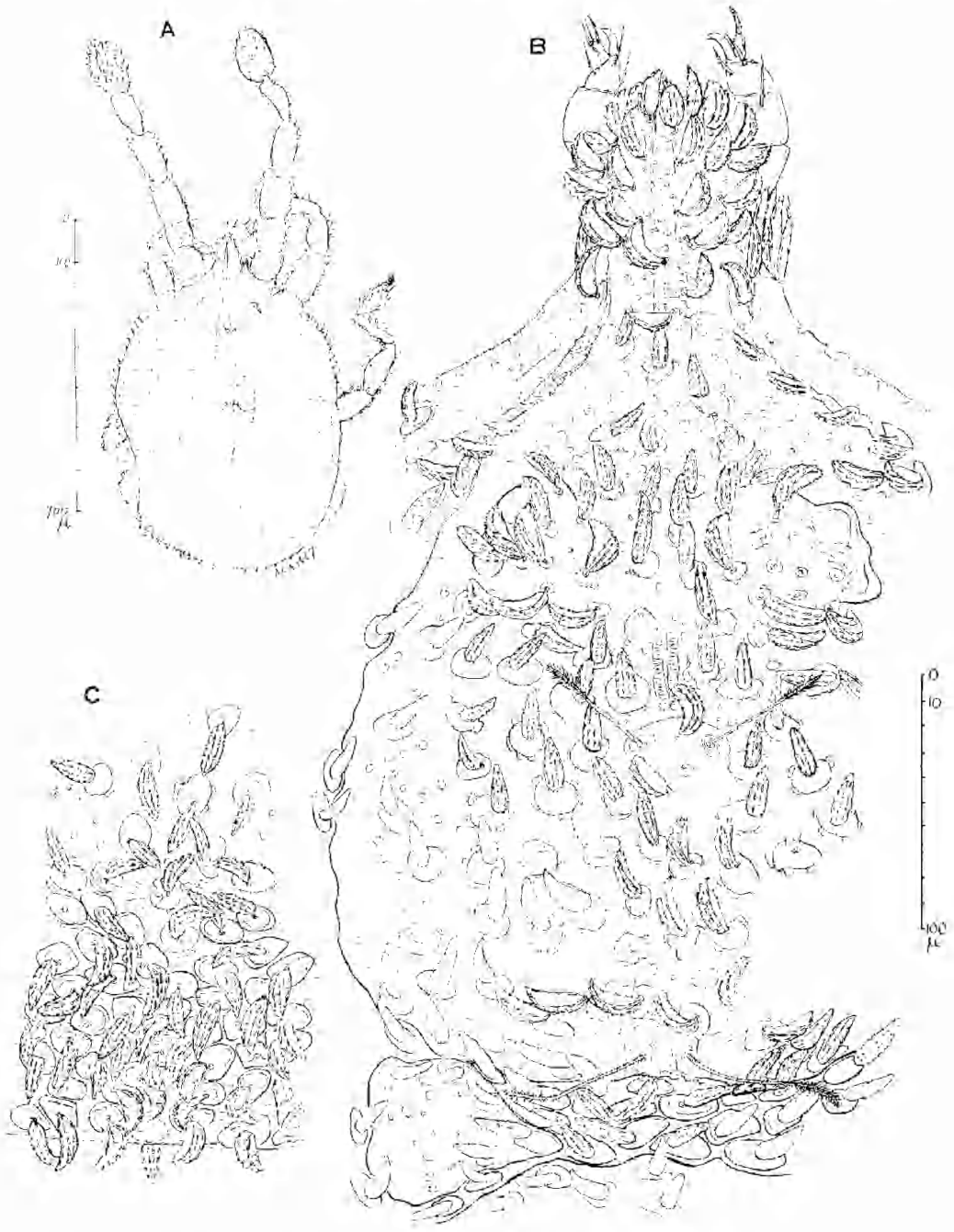

Fig. 10. *Smaris grandjeani* subsp. *christensoni*, subsp. nov. Adult male (holotype). A, outline of specimen in slide mount, mainly in dorsal view but partly as a transparency, setae mostly omitted. B, palpi, nasus, anterior dorsal shield, middle dorsal shield (left), and some adjacent structures, including the anterior edge of the posterior dorsal shield. Chelicerae are also outlined below the nasus, and the details of the eyes, sensillae, scobalae, etc., of the anterior dorsal scutum are shown. C, posterior pole of idiosoma in dorsal view, including part of posterior dorsal shield. (B and C to scale on right.)

Description of Nymph (from specimens ACA 1731 C, D).

The standard data of the two specimens studied are:

	ASens	PSens	SBa	SBp	ISD	DS
ACA 1731C	48	66	18	18	96	24-30
ACA 1731D	46	—	22	18	96	24-34

The dorsal idiosomal scobalae are similar to those of the adult, but are more elongate and the tectum setae has 5-6 columns of spicules in up to 14-15 rows. A typical dorsal scobala near the posterior pole of the idiosoma measures 28-30μ long by 7-8μ wide.

Specimen ACA 1731C has the idiosoma 810μ long by 590μ wide (somewhat compressed). Leg I is 435μ long inclusive of trochanter to tips of claws, tarsus I 102μ long by 56μ wide, tibia I 94μ long, genu I 90μ long, tarsus II 61μ long by 26μ high, tibia II 70μ long, tarsus IV 68μ long by 27μ high, tibia IV 94μ long, genu IV 94μ long (tarsi measured without claws or pedicle). (This specimen is in polyvinyl alcohol medium and is not ideal for description.)

Specimen ACA 1731D (mounted along with ACA 1731C and in similar condition) with idiosoma 805μ long, 570μ wide, tarsus I 104μ long by 60μ across by 49μ high, tibia I 94μ long, genu I 89μ long, tarsus II 61μ long by 28μ high, tibia II 73μ long, tarsus IV 65μ long by 26μ high, tibia IV 94μ long, genu IV 91μ long (tarsi measured without claws or pedicle).

Material Examined (all single adult specimens, except ACA 1731C, D).

ACA 1664, paratype, on *Neotoma*, Monterey, California, May 27, 1945, J. M. Linsdale, No. 562, Lot 46-865, in United States National Museum collection.

ACA 1665, paratype, on *Odontoglossum grande*, Guatemala: at Brownsville [, Texas], March 25, 1947, Lot 47-4989, in South Australian Museum collection ex U.S.N.M. collection.

ACA 1666, paratype, on orchid plants, "Mexico, D.F.", at Laredo, Texas, June 2, 1947, E. C. Harrison, Lot 47-8714, in South Australian Museum ex U.S.N.M.

ACA 1667, on orchid plants, Vera Cruz, Mexico: at Laredo, August 15, 1947, Jackson, Lot 47-12413. Male specimen, Holotype, in United States National Museum.

ACA 1668, paratype, on orchid plant, Guatemala, at Brownsville, October 27, 1947, Alexander, colr., Lot 47-16106, U.S.N.M.

ACA 1669, paratype, in soil, Mesilla, New Mexico, February 4, 1938, L. D. Christenson, 5775, Lot 38-13954, U.S.N.M.

ACA 1720, paratype, Petrero Grande, Mexico, January 15, 1943, F. Bonet, B689. Male, in South Australian Museum Coll.

ACA 1731A, paratype, Nevada de Colima, Jal[isco], Mexico, January 21, 1943, No. 715, S.A.M. Coll.

ACA 1731 C, D, two nymphs, same collection data as preceding, S.A.M. Coll. (described above).

Remarks. This species may be distinguished from *Smaris grandjeani grandjeani* as in the key to *Smaris* above. This subspecies is named for its original collector (see ACA 1669, above).

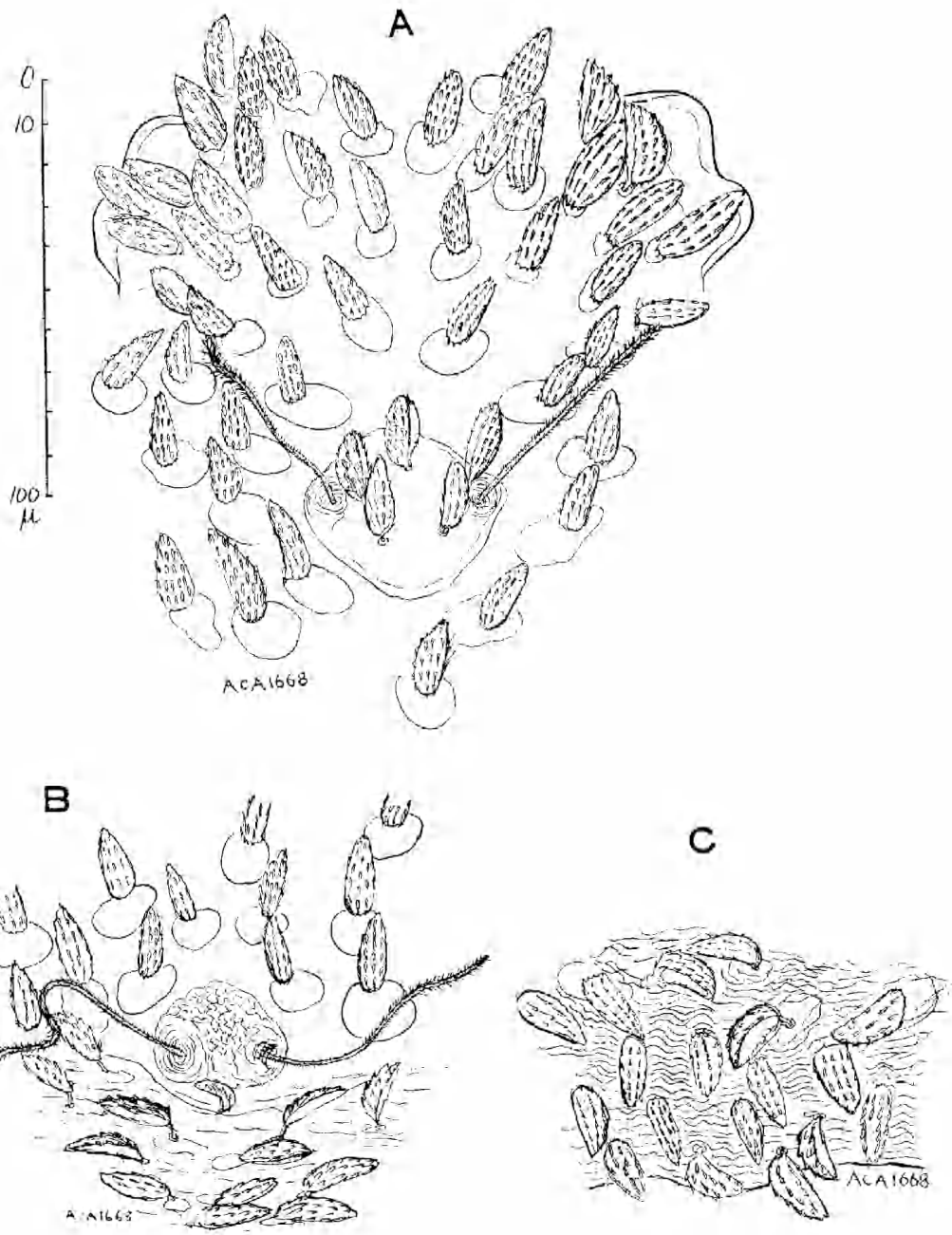

Fig. 11. *Smaris grandjeani* subsp. *christensoni*, subsp. nov. Adult, from paratype specimen ACA 1668. A, anterior sensillary area, eyes, and adjacent structures. B, posterior sensillary area and adjacent structures. C, posterior pole of idiosoma, in dorsal view. (All figures to scale shown.)

Smaris boneti sp. nov.

Figs. 12-14

Description of Adult Male (from the Holotype ACA 1731B).

Colour in life not recorded. Animal of normal smaridid shape, fairly robust, with a short nasus, and with lightly sclerotized plates. Idiosoma 1130μ long to tip of nasus by 760μ wide where widest.

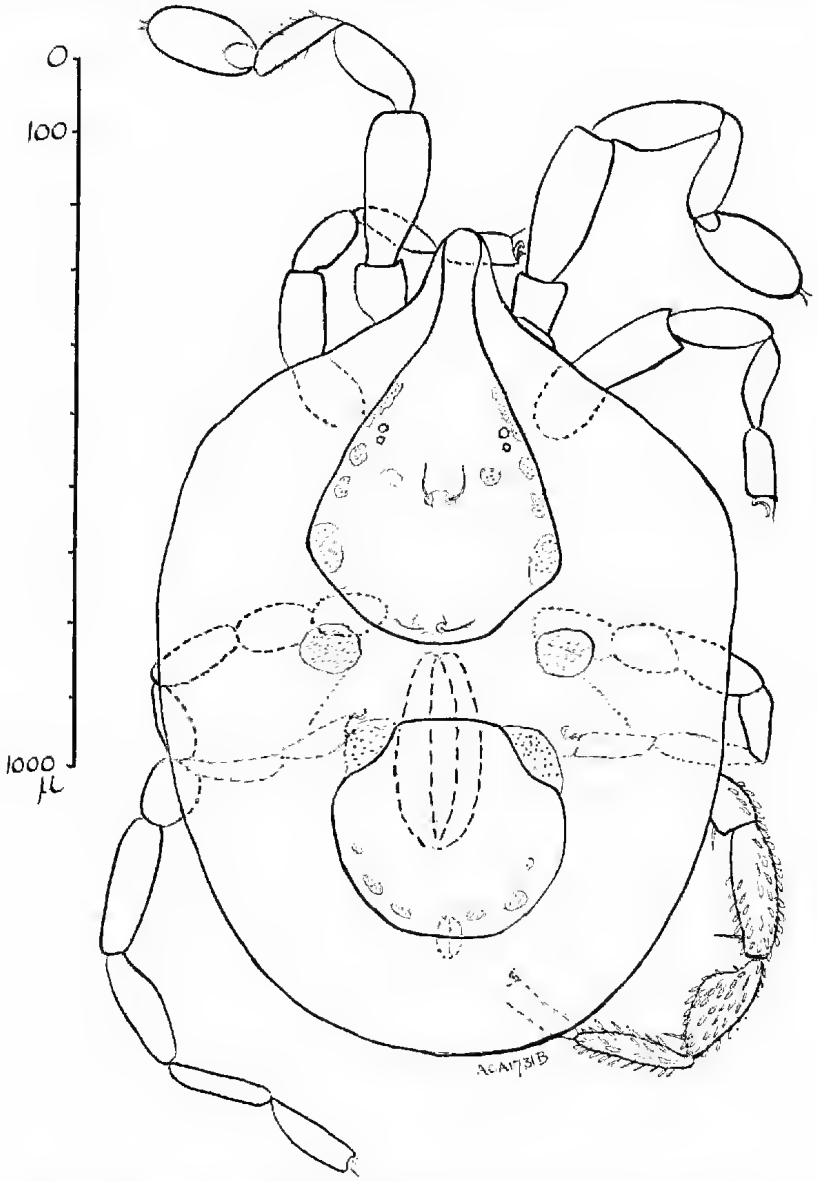

Fig. 12. *Smaris boneti*, sp. nov. Adult male (holotype), dorsal view, but showing some ventral structures (broken lines), setae mostly omitted

Anterior dorsal scutum present, 560μ long by 375μ wide, enclosing the sensillae and eyes, going forward on to the nasus; it is roughly pyriform, but with the edges somewhat irregular. There is practically no extension of the anterior dorsal scutum to form an ocular projection in the vicinity of the eyes. The shield has some punctate asetose areas, as figured (see Fig. 12), but these are not clearly demarcated on the scutum and they are difficult to elucidate. In the holotype the anterior and posterior dorsal idiosomal shields are well separated.

Eyes 2 + 2, each lateral pair closely approximated, but there is only a slight tuberosity on the anterior scutum for each lateral eye pair. Anterior eye the larger, cornea 24μ across, directed anterolaterally, posterior eye slightly lateral to anterior eye, with cornea 22μ across, directed posterolaterally. The eye tuberosity carries a few scobalae similar to the adjacent dorsal idiosomal scobalae, but slightly larger than those adjacent on the anterior dorsal scutum. Eyes fairly close to the lateral border of scutum, as figured (Figs. 12, 14A).

Anterior sensillary boss wide, carrying the two anterior sensillae and eight normal dorsal type scobalae. Anterior sensillae slender, parallel-sided, terminally blunted, ciliated, the terminal ciliations long. Posterior sensillary boss only lightly sclerotized, similar to anterior but slightly clavate in terminal part, and blunted terminally. The scutal scobalae have a convex tectum, lanceolate in outline, angled basally, and with the tectum setae with regularly arranged tuberous spicules. Each scutal scobala arises from an irregular pit; the scutum thus having the usual cribriform appearance of the anterior dorsal scutum.

The standard data of the holotype are as follow:

ASens	PScus	SBa	SBp	ISD	DS
80	85	47	26	170	22-30

Posterior dorsal scutum of moderate size, more or less rounded, of similar nature to the anterior dorsal scutum, ca 260μ long by 280μ wide. Attached to its anterolateral angles are two asetose areas which tend to project away from the remainder of the scutum; these overly muscular insertions. Some smaller asetose areas are present on the posterior part of the posterior dorsal scutum, as figured (Fig. 12). The scobalae of the posterior dorsal scutum are uniform in character and are similar to the other dorsal idiosomal scobalae. Two asetose areas are also present in the mid-dorsal position, and each is about halfway between the dorsal median line and the lateral edge of the idiosoma, as shown in Fig. 12.

Dorsal idiosomal scobalae are typically smaridid, with a wide tectum setae and a deep keel, the seta angled basally. The tectum setae lanceolate, widest about 1/3 along the scobillum, blunt-pointed apically; the tectum carries 6-8 columns of tuberous spicules, in 9-13 rows in the wider part of the tectum; distally the spicules diminish in number, but only a little in size. The setae arise either from pits (on the major shields) or from small individual seta-plates, sclerotized, excavated centrally, resembling a coracle lying among the dorsal striations (see Figs. 13A,B; 14A,B).

Ventral sclerotization of normal type for genus, detail of shields similar to that of the dorsum (venter not clearly seen as the only specimen available is the holotype, mounted back uppermost). External genitalia and anus appear normal.

Legs robust, normal, moderately sclerotized. Leg lengths (including trochanter to tip of tarsal claws): I 750μ, II 605μ, III 600μ, IV 775μ. Tarsus I 155μ long by 93μ across, tibia I 142μ long, tarsus II 104μ long by 47μ high, tibia II 125μ long, tarsus IV 119μ long by 42μ high, tibia IV 165μ long (tarsal lengths exclude claws and pedicle). Scobalae of legs similar to those of idiosoma but the scobalae tend to be more elongate, particularly distally, with more outstanding spicules/ciliations. On the tarsi the scobalae are quite pointed with pointed ciliations. Sensalae of legs characteristic of Smarididae. Tarsal claws ciliated along their sides except at tip.

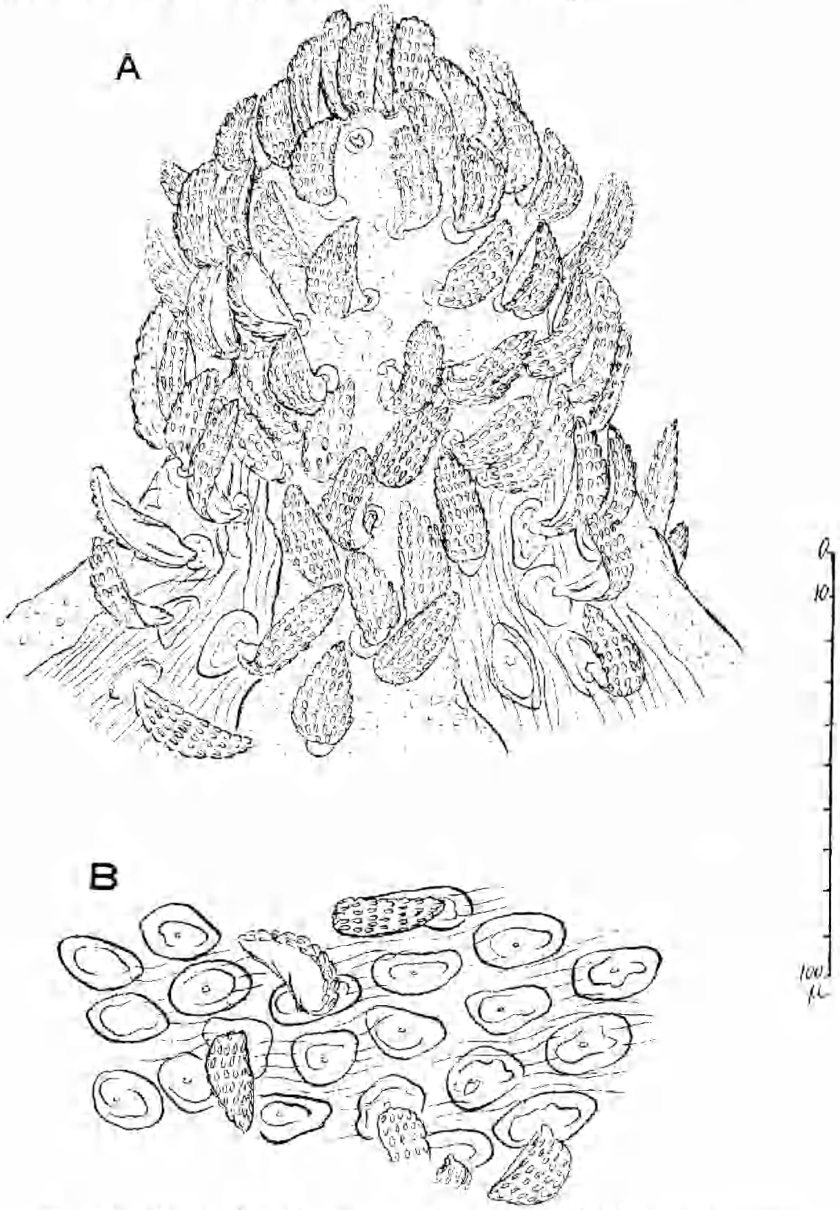

Fig. 13. *Smaris boneti*, sp. nov. Adult male (holotype). A, nasus and adjacent structures, dorsal view. B, scobalae near posterior pole of idiosoma dorsally. (Both to scale shown.)

Gnathosoma is in the retracted position in the holotype, and only the tip of the palp protrudes; palpal scobalae pointed, lightly ciliated.

Locality. This species is known from only the holotype, slide labelled Nevada de Colima, Jal[isco, Mexico], January 21, 1943, F. Bonet, No. 715; type slide in South Australian Museum collection, with identification number ACA 1731B. The mite was remounted from polyvinyl alcohol mountant to methyl cellulose medium on January 28, 1961, by the author, and to gum chloral medium on September 27, 1961; it is somewhat damaged.

Genus CALOREMA, gen. nov.

Unnamed new genus, undescribed Southcott 1961*a*, p. 438 (referred to in text on line 1; also referred to in second part of caption 3 (1) of the key).

Type species (original designation): *Calorema azteka*, sp. nov.

Definition. Octopod stages typically smaridid in shape. Eyes 2 + 2, placed level with or anterior to anterior sensillary area. The dorsal idiosomal sensillary areas enclosed by a paddle-shaped shield of prominent reticular structure, which does not enclose the eyes. Anterior sensillae behind middle of scutum. Coxae I and II do not fuse across the mid-line to form an anterior ventral shield, but have a narrow median gap between them. Chitin of legs, particularly coxae to tibiae, as well as dorsal scutum, with prominent reticular structure.

Larva not known.

Remarks. This genus may be separated from others of the subfamily Smaridinae in the adult and nymphal stages as in the key given earlier (Southcott, 1961*a*, p. 438, last entry).

Calorema azteka sp. nov.

Figs. 15-19

Description of Adult Male (from the Holotype ACA 1646) (Figs. 15, 16).

Colour in life not recorded. Of normal adult smaridid shape and dimensions, with a distinct nasus. Idiosoma 790μ long to tip of nasus by 480μ wide where widest.

Dorsal scutum paddle-shaped, the handle pointing anteriorly, and covering the dorsum of the nasus, 315μ long by 120μ wide where widest, a level about 230μ back from the anterior tip; the handle somewhat broadened over the nasus, and flattened along its anterior margin; a neck present about 60μ back from the anterior tip, the neck there 36μ wide. Anterior sensillary area present on scutum, behind its middle, and posterior to eye level. Posterior sensillae at posterior end of scutum.

The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
30	(missing)	22	22	125	14-24

Anterior sensillae slender, slightly thickened in middle, distally tapering, ciliated throughout their length, the ciliations minute in the proximal third, ter-

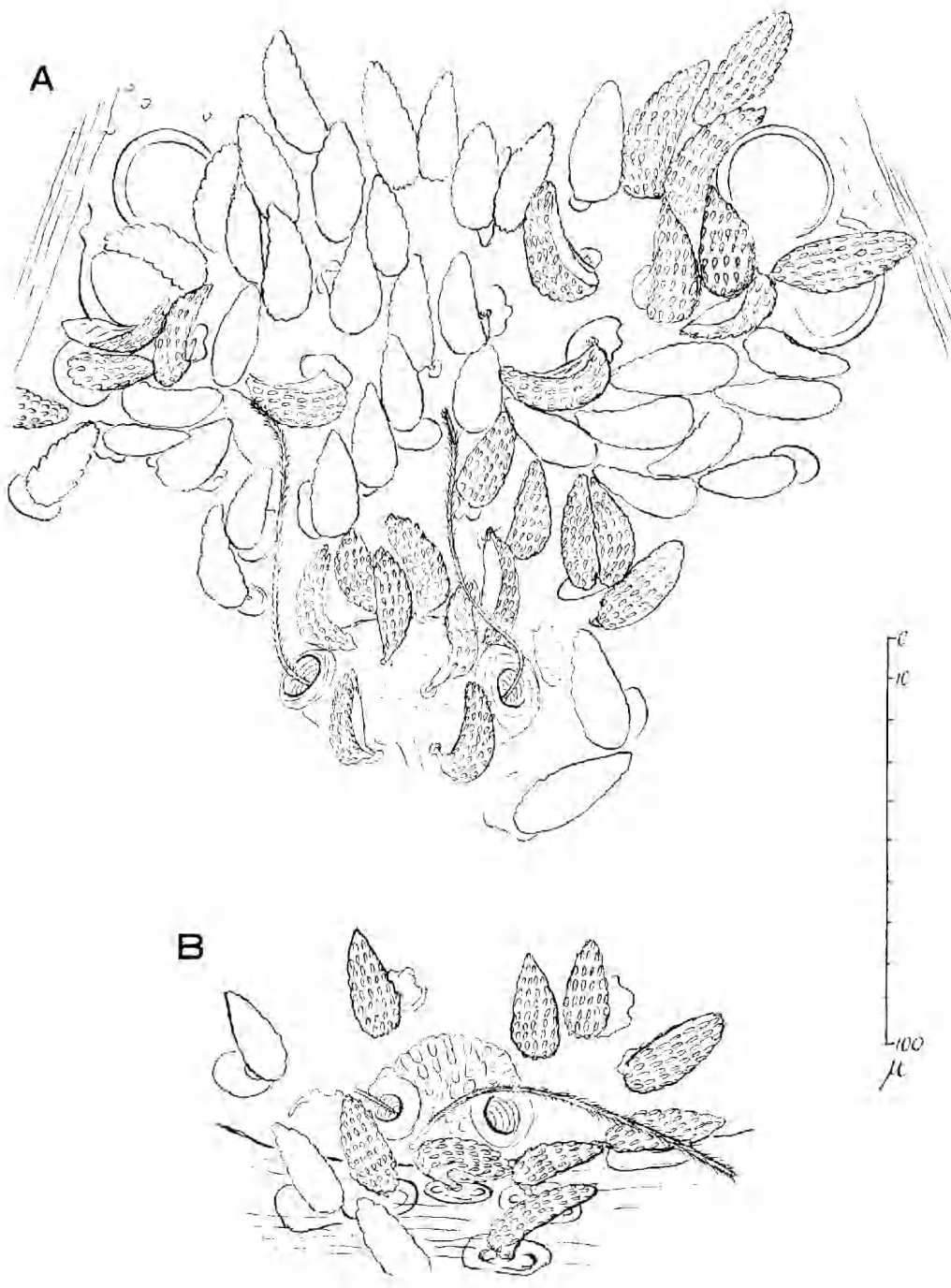

Fig. 14. *Smaris boneti*, sp. nov. Adult male (holotype). A, eyes, anterior sensillary area and adjacent structures. B, posterior sensillary area and adjacent structures; the right posterior sensillary seta has been dislocated from its socket. (Both figures to scale shown.)

minally the ciliations longer and there forming a spindle-shaped brush. Posterior sensillae missing in holotype, but in a paratype male specimen (ACA 1642) they are slender, slightly tapering, ciliated throughout, with ciliations longer in distal half of sensilla. Posterior sensilla 65μ long.

The chitin of the scutum has a prominent reticular structure, except for the track formed between the anterior and posterior sensillae, and around the anterior sensillae as figured (Fig. 16), thus outlining a crista incorporated in the scutum. The actual sensillary areas are differentiated by their having a separate pattern of smaller holes in their chitin. Scutum with setation in general similar to the normal dorsal idiosomal scobalae. Nasal setae 18-22μ long, other scutal scobalae 12-16μ long. Scutal scobalae behind the nasal setae and anterior to the anterior sensillary area are unpigmented (except for 4 scobalae at the anterior edge of the anterior sensillary area); one such unpigmented scobala seen 56μ anterior to posterior mid-sensillary point, and 20μ to right of mid-line, thus being about halfway between mid-line and lateral border of the scutum at that level, otherwise the scutal scobalae are light brown, the same as the majority of the idiosomal scobalae.

Eyes 2 + 2, the anterior eye larger and more medial, 22μ across. Posterior eye 16μ across. The eyes are placed at the ocular projection of the anterior part of the idiosoma dorsally, between the conjoined edges of coxae I and II, or slightly anterior to this vertical plane.

Dorsal idiosomal scobalae numerous, typically smaridid in structure, the tectum setae convex and with 4-5 irregular columns of coarse saw-teeth, these serrations or spicules projecting prominently; the carina or keel provided with an expanded flange, also cut at its edges into prominent curved saw-teeth. The dorsal scobalae longer posteriorly; most setae lightly pigmented with brown; among them, however, are several patches of unpigmented setae, these being (additional to those recorded for the dorsal scutum) (1) an irregular somewhat transverse patch behind the posterior sensillae; (2) a rounded patch about 120μ across by 90μ long, of about 22 setae, placed toward the posterior pole of the idiosoma behind the level of coxae IV, its mid-point level with the femoral (IV) pseudoarticulation (there is no sign of any underlying scutum to this patch or in this region, but the patch is placed where one would expect to find the normal posterior dorsal idiosomal scutum in the genus *Smaris*).

Venter: the anterior coxae I and II of each side form a conjoined antero-lateral coxal plate, as applies in the Erythraeoidea generally. These two anterior lateral coxal plates nearly meet in the mid-line, the separation being only 8μ, and this almost straight medial border of each anterior coxal plate is made up in its anterior 2/3 from coxa I and the remainder from coxa II. Anteriorly there is also an oblique part of the medial border of coxa I. The posterior coxae (III and IV) form on each side a posterior coxal plate, as is usual in the Erythraeoidea, these being well separated (see Fig. 15). The posterior coxal plate has no flange or any additional plate in front of coxa III. All coxae with heavy chitin, with prominent reticular structure. External genitalia and anus normal. Ventral idiosomal setae normal, with pointed ciliations. Internal genital armature shows that the holotype is a male; the external genital orifice with the normal paired lips.

Legs normal, except that the chitin has a prominent reticular structure, present on all segments except tarsi, where it is less marked. Leg lengths (including trochanter and tarsal claws): I 715μ, II 515μ, III 590μ, IV 810μ. Tarsus I 131μ long by 52μ high, tibia I 170μ long, genu I 148μ long, tarsus IV 119μ long by 28μ high, tibia IV 203, 211μ long, genu IV 169μ long (tarsal measure-

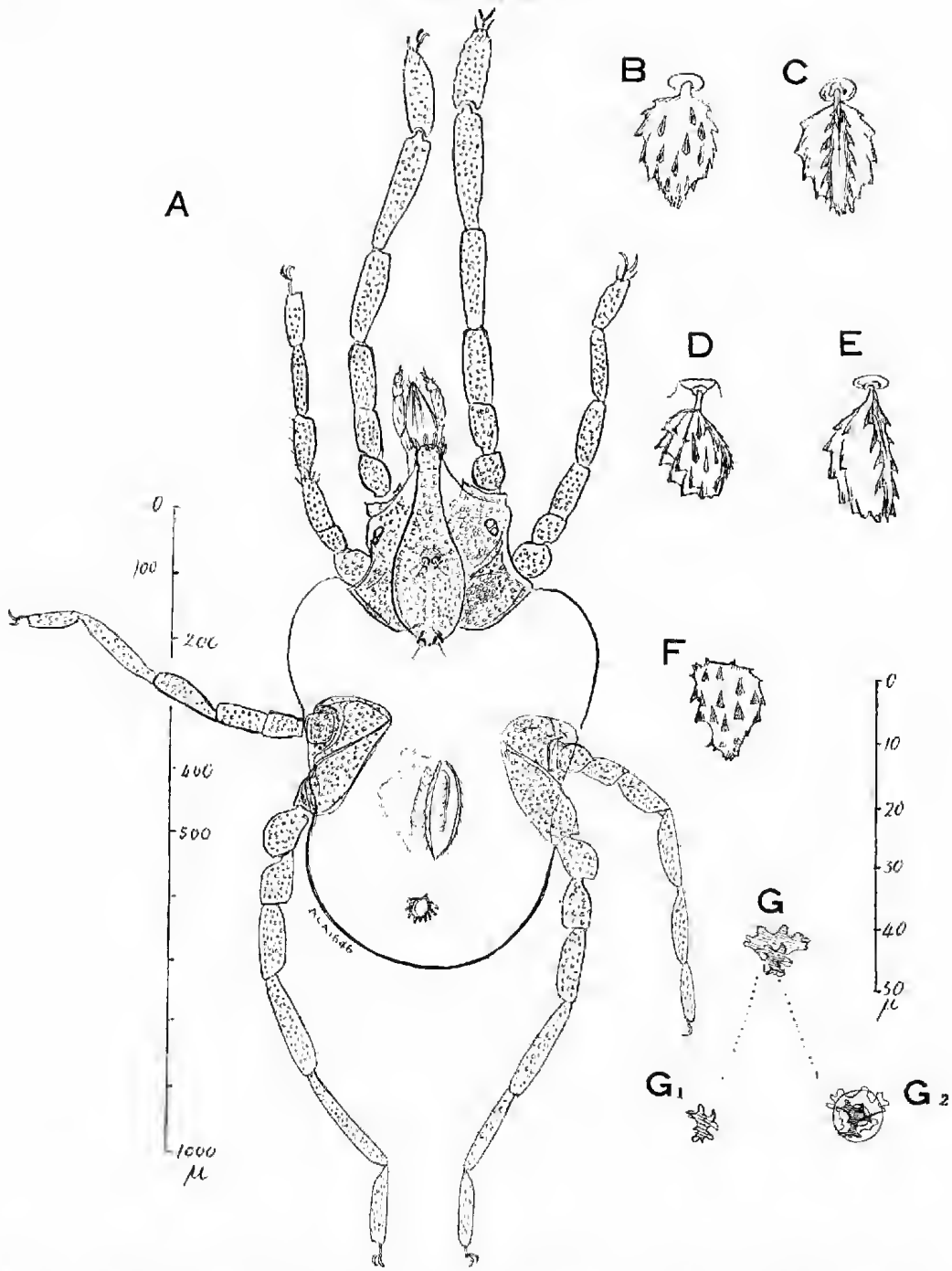

Fig. 15. *Calorema azteka*, sp. nov. Adult male (holotype). A, entire, by transmitted light, but giving preference to the dorsal view, setae mostly omitted. B-G, dorsal idiosomal scobalae, various aspects: B, scobala in dorsal or tectal aspect; C, scobala in ventral or carinal aspect; D, E, oblique views, D, tectal oblique view, E, carinal oblique view; F, end view, somewhat tectal; G, end view of scobala, showing inset: G_1, end view of the seta tip, G_2, the outline superimposed over the annulus (seta base) and bulb of the pedicle. (A to scale on left; setae to scale on right.)

ments excluding claws and pedicle). Tarsi with usual supraonychial setae. Tarsal claws ciliated obliquely along their sides, except at tip.

Gnathosoma as figured. Palpal scobalae moderately ciliated.

Description of Allotype Adult Female (from ACA 1649).

Similar to male in general structure. The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
28	ca 55	24	21	127	14-22

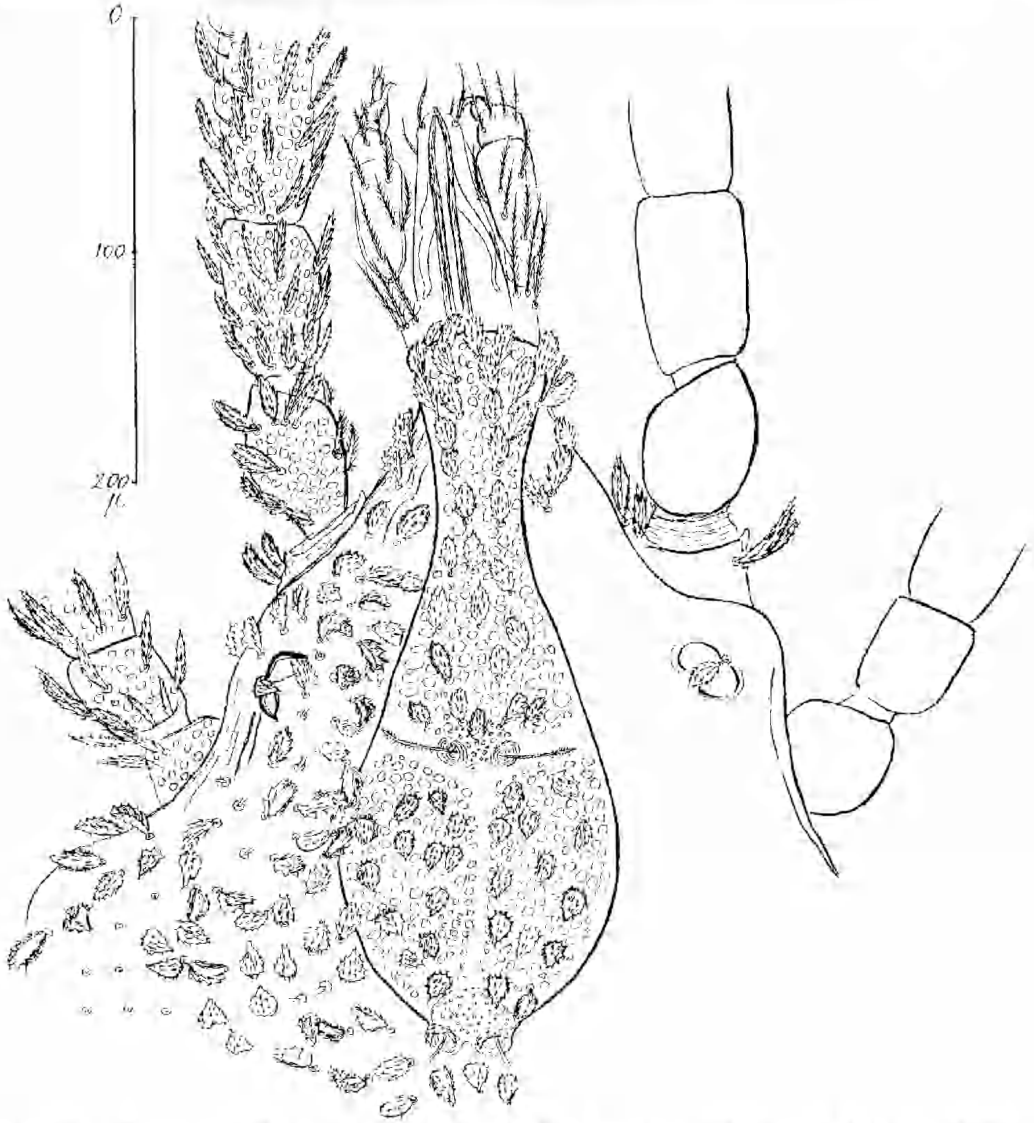

Fig. 16. *Calorema azteka*, sp. nov. Adult male (holotype), anterior part of idiosoma dorsally, and adjacent structures (setae mostly omitted on right).

Tarsus I is 121μ long by 46μ high by 60μ across, tibia I 164μ long, genu I 150μ long, tarsus IV 102μ long by 32μ high, tibia IV 175μ long, genu IV 158μ long (tarsal lengths exclude claws and pedicle).

Description of Nymph (from the "Nymphotype", ACA 1650) (Figs. 17-19).

Colour not recorded. The animal is of normal nymphal smaridid build. Idiosoma 770μ long by 490μ wide (the specimen is rather compressed in the slide mount; see Fig. 17). Dorsal scutum more slender than in adult, 236μ long by 36μ wide, where widest (about 1/3 back from anterior sensilla towards the posterior sensilla).

The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
36	57	14	13	99	24-41

Sensillae of dorsal scutum similar to adult, but more slender. The scutum has only a few scobalae (see Fig. 18A); there are 4 setae forming a curved row at the nasal tip of the scutum, 28-30μ long.

Eyes 2 + 2, level with or a little anterior to anterior sensilla as figured (Fig. 18A). Anterior eye 22μ across, posterior 16μ across.

Dorsal idiosomal scobalae typical of a nymphal smaridid, elongate, with about 4 columns of saw-teeth; setae are fairly uniform in length over the dorsum, including the scutum, and none are unpigmented in the "Nymphotype".

Venter similar to adult, except that the genitalia are of the nymphal character.

Legs similar to adult, but more slender; the leg lengths are (including trochanters and tibial claws): I 615μ, II 445μ, III 455μ, IV 590μ. Tarsus I 106μ long by 51μ high, tibia I 148μ long, genu I 118μ long, tarsus IV 73μ long by 32μ high, tibia IV 146μ long, genu IV 123μ long (tarsal lengths exclude claws and pedicle).

Gnathosoma similar to adult, but more slender.

Material Examined and Locality and Other Data.

Holotype male, ACA 1646: On banana leaf debris. Panama: at Philadelphia, Philadelphia. October 9, 1933, A. B. Wells, U.S.N.M. Ref. No. Phila. No. 19392. In United States National Museum collection.

"Nymphotype", ACA 1650. Moss, Desierto de los Leones, Mexico. December 12, 1943. Collector not stated. In U.S.N.M. (This slide contains also an adult pachygnathid mite, ACC 824, ?*Nanorchestes* sp., but with the posterior sensillae somewhat clavate.

ACA 1642, paratype, adult male. On banana debris. Mexico: at Galveston, Texas, U.S.A. Coll. S. R. Morris, February 16, 1937. Lot 37-4801. Remounted in methyl cellulose mountant January 11, 1961.

ACA 1643, paratype, adult, ?sex. On *Laelia majalis*. Antiguo[-]Morelos, Mexico: at Brownsville, Texas. April 2, 1947. Lot 47-4992. Name of collector not stated. Specimen retained in South Australian Museum collection ex U.S.N.M.

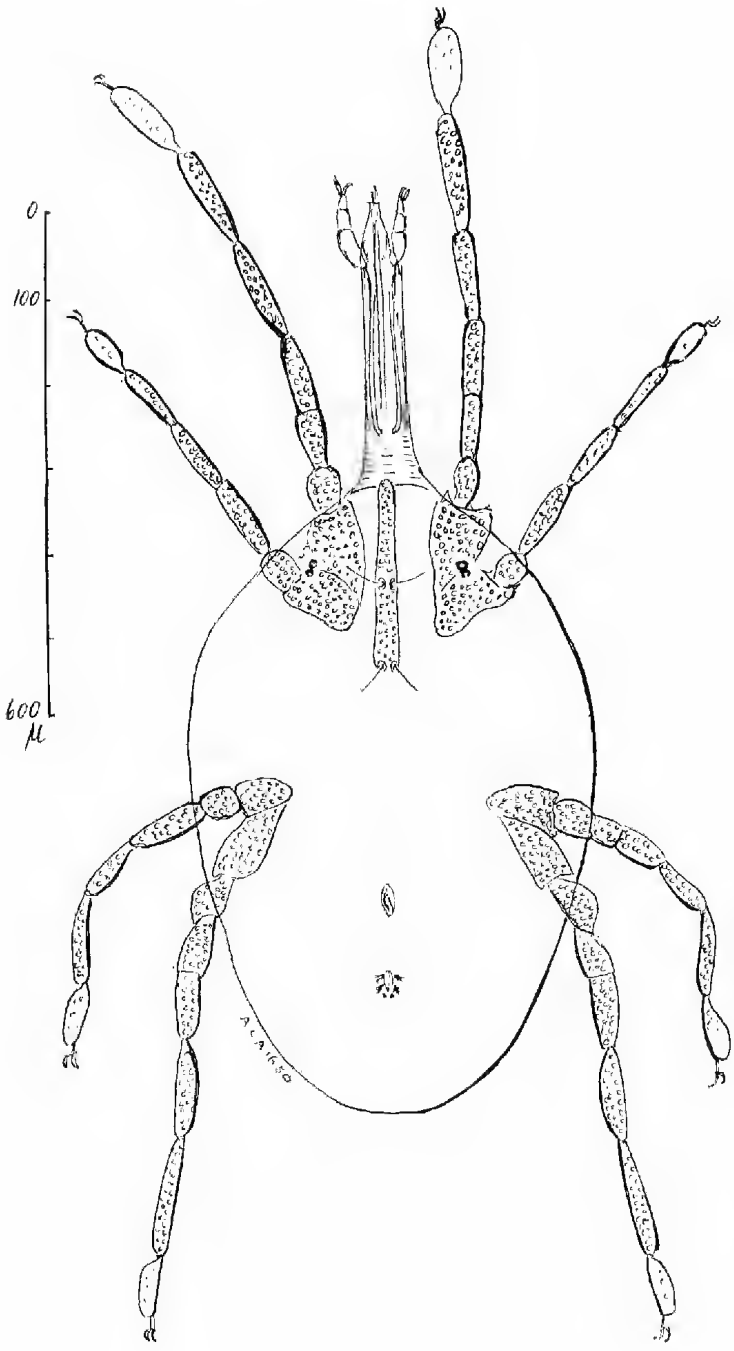

Fig. 17. *Calorema azteka*, sp. nov. Nymph (specimen ACA 1650), in transparency, viewed from dorsum, setae mostly omitted.

ACA 1644, paratype, adult, probably male. On orchid plant, S[an] L[uis] P[otosi], Mexico: at Laredo, Texas, May 14, 1946, Babb, coll. Laredo 39239, Lot 46-7030. In polyvinyl alcohol mountant (heated) according to slide data. Remounted in methyl cellulose mountant January 11, 1961.

ACA 1645, paratype, adult, probably female. On orchid plants, Mexico, at Laredo, Texas. December 29, 1945. Fouts, coll. Laredo 37961, Lot 46-542. PVA mountant, not heated, in South Australian Museum ex U.S.N.M.

ACA 1647, paratype, adult, ?female. On orchid plant, Tamazunchale, [S.L.P.,] Mexico: at Laredo, Texas, May 20, 1946. Babb, coll. Laredo 39613, Lot 46-7971. PVA—heated. U.S.N.M.

ACA 1648, paratype, adult, ?sex. On orchid plants, Maiz, S.L.P., Mexico: at Laredo, Texas, March 18, 1947. Fouts, coll. Lot 47-4243, retained in S.A.M. collection ex U.S.N.M.

ACA 1649, adult female, allotype, data as ACA 1648, in United States National Museum collection.

ACA 1658, paratype, adult, probably female. On *Laelia majalis*. Antiguo-Morelos, S.L.P., Mexico: at Brownsville, Texas, March 18, 1947. Name of collector not stated. Lot 47-4105; in South Australian Museum collection ex U.S.N.M. collection.

ACA 1717. Three specimens, small adults. Petrero Grande, [Mexico,] June 15, 1943, F. Bonet, Ref. B689 or No. 29, Bonet. In South Australian Museum collection (slide in poor condition).

Remarks. The nymph is correlated with the adult on morphological grounds, particularly the structure of the dorsal idiosomal scobalae.

The genus *Calorema* is somewhat intermediate between *Smaris* and *Fessonia*, as remarked previously by the author (1961*a*), and its discovery was the cause of the fusing of the Smaridinae and the Fessoniinae.

The geographical spread of this interesting monotypic genus may be noted. Its recorded distribution is at present Panama and Mexico, which is reflected in the specific name *azteka*.

Genus Fessonia Heyden

Restricted by Womersley and Southcott (1941).

For synonymy see Southcott, 1961*a*, p. 441, and in addition, *Fessonia* Southcott, 1961*b*, p. 146.

For definition and discussion on the type species see Southcott (1961*a*).

Remarks. Previously described species of this genus are *F. papillosa* (Hermann) Berlese, 1884 (A.M.S. 16, 3) from Europe, with which the European *F. callitricha* (Grandjean, 1947) is probably synonymous, according to Grandjean (loc. cit.) (see Southcott, 1961*a*, p. 441), *F. australiensis* Southcott, 1946, described from northern Australia, and *F. taylori* Southcott, 1961 (1961*b*, p. 146) described from one locality in New South Wales.

In North America the evidence from the present study suggests that *Fessonia* is mainly a tropical or subtropical genus; this agrees with the distribution in Australia (Southcott, 1946, 1961*b*). However, in Europe *F. papillosa* (= *callitricha*) is found in cold climates (Grandjean, 1947, p. 39).

In the present paper *F. australiensis* is recorded from North America, in Hawaii ex China, as well as other Asian localities, and a further Australian

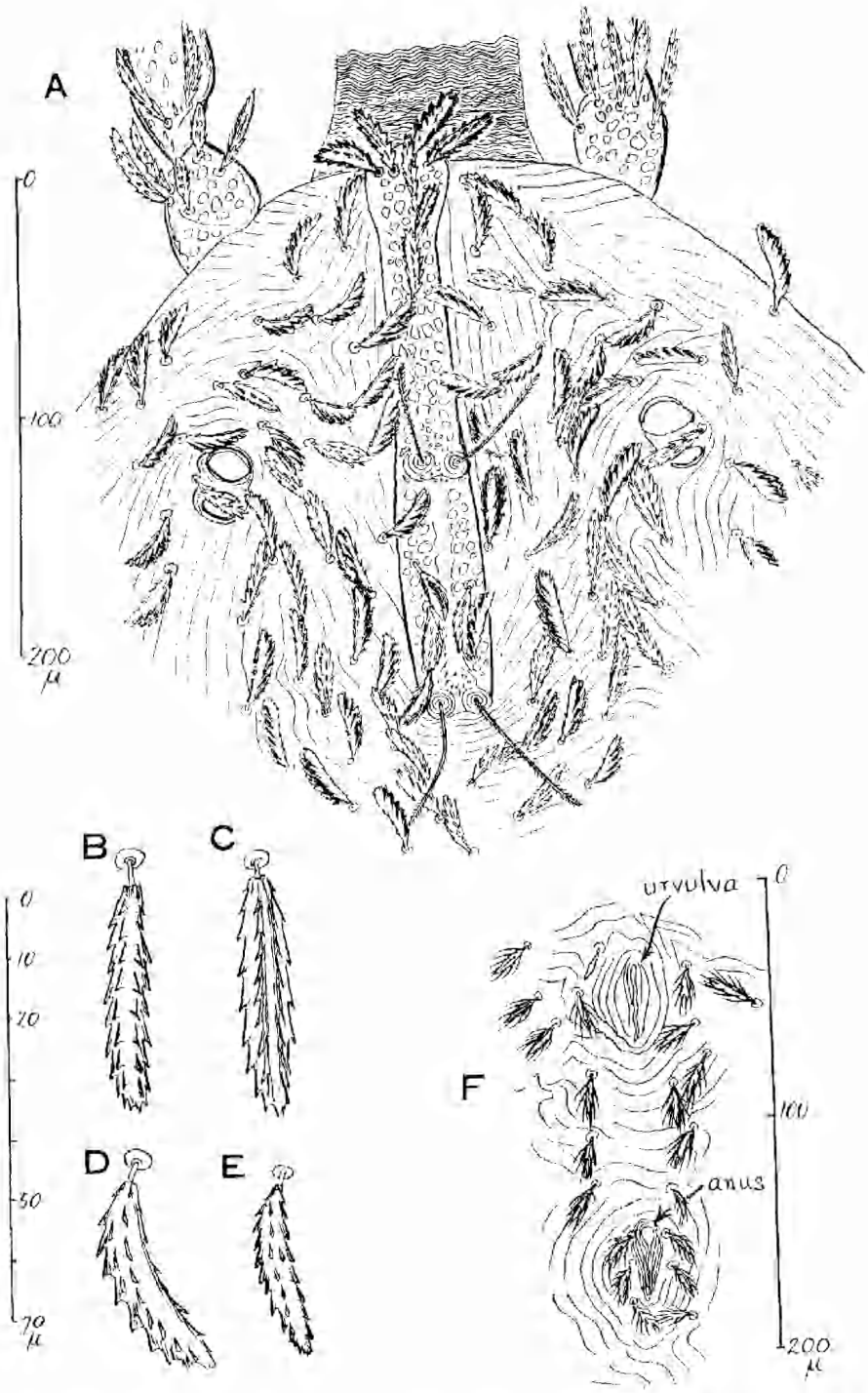

Fig. 18. *Calorema azteka*, sp. nov. Nymph (specimen ACA 1650). A, anterior dorsal part of idiosoma and adjacent structures, to scale on left. B-E, dorsal idiosomal setae (scobalae), various aspects, to scale on left. F, urvulva and anus, and adjacent structures, to scale on right.

specimen is recorded. In addition, four new species are described from North and Central America, and recorded for various localities, these species being *F. serrata*, sp. nov., *F. lappacea*, sp. nov., *F. scobina*, sp. nov., and *F. lacrimosa*, sp. nov.

In view of the wide distribution now recorded for *F. australiensis*, the following key to the species of the genus *Fessonia* for the world is submitted (accepting that *F. papillosa* and *F. callitricha* are synonymous).

Key to the World Species of the Genus *Fessonia*.

1. Spicules on tectum of dorsal idiosomal form consistently well-defined columns over at least part of the tectum setae 2

   Spicules on tectum of dorsal idiosomala not consistently forming well-defined columns or rows; they are arranged irregularly or at most form ill-defined or inconsistent columns and rows 5

2(1). Dorsal idiosomalae lanceolate, and with tectum setae with a series of longitudinal columns of spicules, physically linked, and running to the apex of the seta 3

   Dorsal idiosomalae without the preceding combination of characters 4

3(2). Tectum setae with four columns of strong serrate spicules, with transverse markings across the tectum setae, linking the columns of spicules. Dorsal setae 24-43μ long . . . *F. serrata*, sp. nov. (North America).

   Tectum setae with 4-6 columns of fine serrations, and without transverse markings

   F. papillosa (Herm.) Berl. (= *F. callitricha* (Grandjean) (Europe)).

4(2). Dorsal idiosomalae with 4-6 longitudinal columns of strong serrations or spicules, not linked to each other, with the two median columns usually regular, running to the apex of the seta. Dorsal idiosomalae clavate, the scobillum almost conical, the distal end blunted, setae 20-41μ long. Palpal scobalae slender, ciliated.

   F. taylori Southcott, 1961 (1961*b*) (Eastern Australia).

   Dorsal idiosomalae with tectum setae lanceolate-clavate, there being 6-8 well-defined columns of linked pointed spicules over the proximal 2/3 of the tectum setae, these columns tending to break up more distally, and in the distal 1/3 of the tectum setae the spicules are discrete, short, blunted, and irregularly arranged. Posterior dorsal scobalae 18-33μ long. Palpal scobalae elongate-lanceolate, ciliated.

   F. australiensis Southcott (Australia, Mexico, India, South-East Asia, etc.).

5(1). Dorsal idiosomalae lanceolate or clavate, with strong projecting serrate spicules arranged irregularly over the convex tectum setae. Spicules of uniform character over the tectum setae. Carina narrow, with long ciliations. Dorsal scobalae 18-30μ long.

   F. lappacea, sp. nov. (North and Central America).

   Dorsal idiosomalae otherwise 6

6(5). Dorsal idiosomalae lanceolate, blunted, tending to elongate posteriorad over the idiosoma. Tectum setae with about 50 small triangular or blunted spicules of nearly uniform character (some of the proximal ones are slightly longer than the others), arranged evenly, and hence in some setae tending to be arranged in columns, rows, or oblique lines. Dorsal scobalae 20-42μ long *F. scobina*, sp. nov. (North America).

   Proximal tectal spicules tend to elongate into the form of tear-drops. Dorsal scobalae 24-42μ long *F. lacrimosa*, sp. nov. (North America).

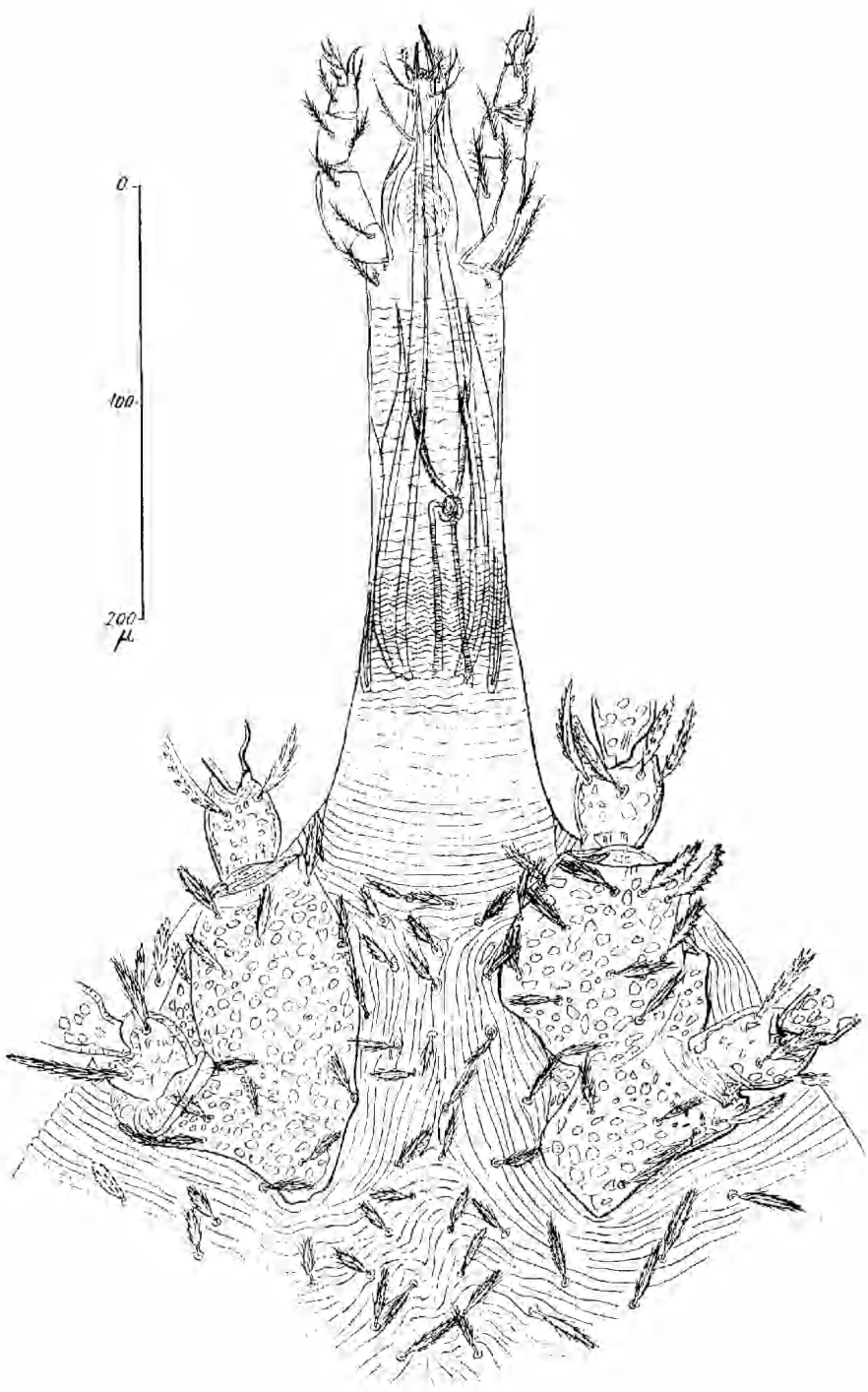

Fig. 19. *Calorema azteka*, sp. nov. Nymph (specimen ACA 1650). Anterior ventral part of idiosoma, and the extended armilla and gnathosoma in ventral view, showing internal structure.

Fessonia serrata sp. nov.

Figs. 20 and 21

Description of Adult Male (from Holotype ACA 1656).

Colour in life not recorded. Animal of normal smaridid shape and dimensions, with a normal nasus. Idiosoma 1130μ long to tip of nasus by 625μ wide where widest.

Crista normal, with two sensillary areas, the mid-point between the two anterior sensillae slender being placed 318μ behind tip of nasus and posterior to eyes.

The standard data of the Holotype specimen are:

ASens	PSens	SBa	SBp	ISD	DS
75	110	17	28	236	24-43

Anterior sensillae slender, ciliated throughout their length, ciliations small in proximal 20μ, then increasing in length except terminally, hence bushy. Posterior sensillae slender, long, ciliated throughout their length, ciliations small proximally, then longer, thickest in central part of sensilla, terminally sparser but equally long.

Eyes 2 + 2, placed as figured, anterior eye the larger, with cornea 20μ across, posterior cornea 15μ across.

Dorsal idiosomalae (scobalae) spindle-shaped or blunted terminally, with strong serrate pointed ciliations arranged in 4 tectal columns; carinal ciliations also long, strong, pointed; faint cross-striations seen across tectum setae between the columns of spicules; setae becoming longer at nasus and over posterior pole of idiosoma.

Venter not clearly seen, as the sole mount is dorsum uppermost, but appears normal. External genitalia normal; internal genitalia of male type.

Legs normal. Leg lengths (including trochanter and tarsal claws): I 1760μ, II 1040μ, III 1095μ, IV 1440μ. Tarsus I 222μ long by 75μ across, tibia I 375μ long, genu I 432μ long, tarsus IV 216μ long by 44μ high, tibia IV 360μ long, genu IV 327μ long (tarsal lengths excluding claws and pedicle). Tarsal claws normal, lightly obliquely ciliated along their sides except at tip. Scobopedalae and sensipedalae of normal smaridid type.

Gnathosoma as figured. Chelicerae digits blunted at tip, with 3 or 4 blunt barbs. Palpi as figured, with moderately ciliated non-expanded scobalae.

Locality. The sole specimen seen is the holotype, ACA 1656, labelled "With orchid plants. Guatemala: at Brownsville. Feb. 8, 1948. Lot 48-1708". Name of collector not stated. In United States National Museum collection.

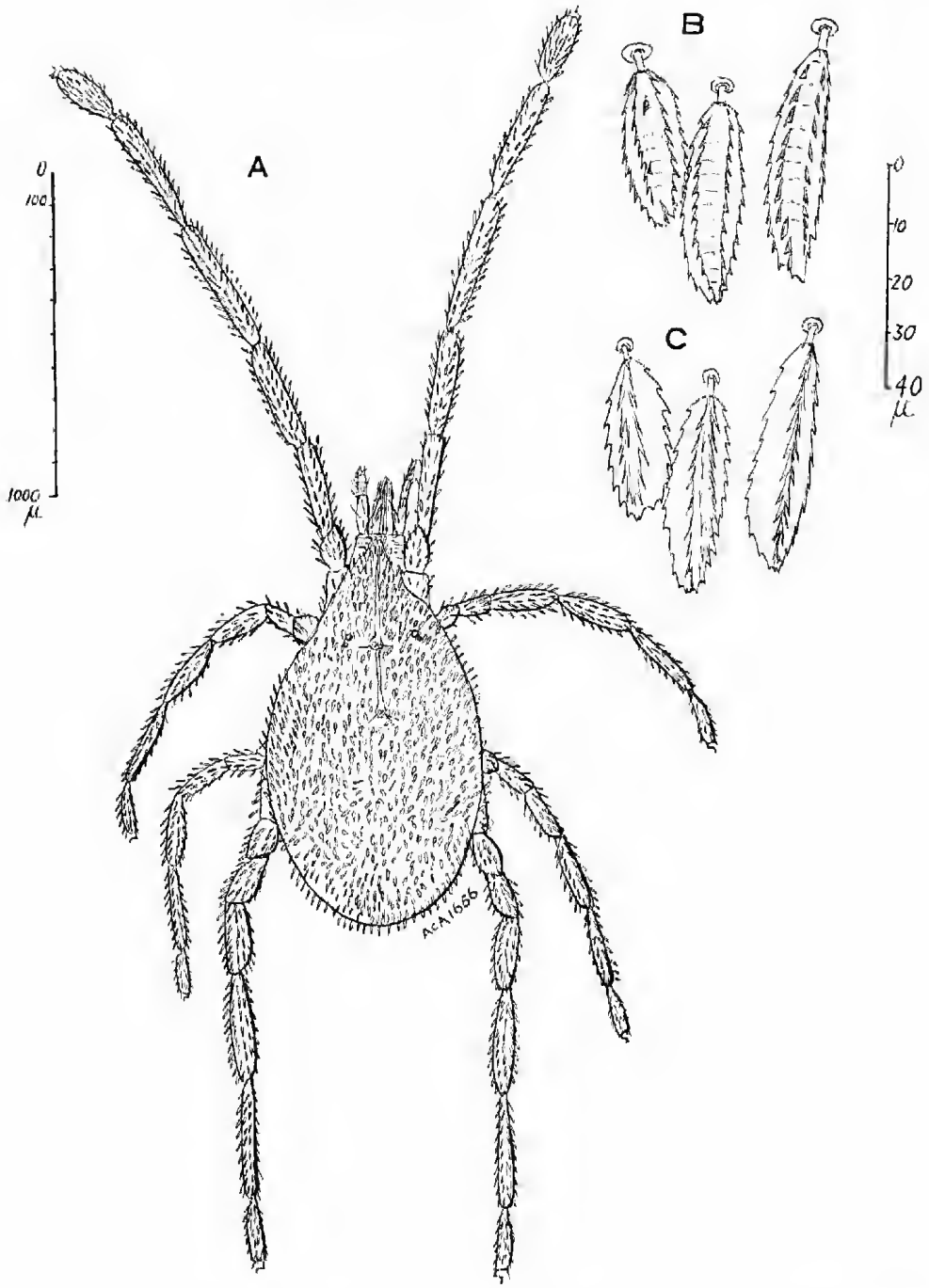

Fig. 20. *Fessonia serrata*, sp. nov. Adult male (holotype). A, entire, dorsal aspect, to scale on left. B, a group of dorsal idiosomal scobalae, toward posterior pole, dorsal (tectal) aspect. C, same setae in ventral (carinal) aspect. (All setae to scale on right.)

Fessonia australiensis Southcott

Fig. 1 J, K

Fessonia australiensis Southcott, 1946, p. 176.

Fessonia australiensis Meyer and Ryke, 1959, p. 322.

Fessonia australiensis Southcott, 1961*a*, p. 441.

Fessonia australiensis Southcott, 1961*b*, p. 150.

Remarks on the Type Series.

In addition to the detail of the dorsal idiosomalae recorded above for *F. australiensis* in the key to the genus *Fessonia* the following additional notes on the dorsalae of the holotype may be made: Cardinal flange of dorsal idiosomae broad and with long pointed ciliations; spicules and ciliations brown.

The following standard data and some other data (in micra) of the type series from Mataranka, Northern Territory, are now submitted:

	ASens*	PSens	SBa	SBp	ISD	DS	Ta I	Ti I	Ge I	Ti I / Ta I
Holotype ♀ ACA 1056 A	51	79	18	22	146	18-33	131	210	197	1·603
Paratype ♀ ACA 1055	53	ca 80	15	22	142	18-33	144	217	201	1·507
Paratype ♀ ACA 1056 B	55	86	19**	22	159	17-32	151	230	227	1·523
Paratype ♀ ACA 1056 C	48	77	16	22	141	19-32	137 135	220 205	199 205	1·606 1·519

*Abbreviations as in Southcott 1961*a*, and, in addition, Ta I = length of tarsus I, measuring as is customary between the chitinous end-points but excluding claws and pedicle; Ti I = length of tibia I, measuring between chitinous end-points, as usual, Ge I = length of genu I, similarly.

**Teratological specimen, see Southcott (1946).

The genu IV of the holotype, specimen ACA 1056A, is 178μ long.

Remarks on a Specimen from Queensland.

A specimen, adult ♀, reddish-pink in life, collected from the base of *Eucalyptus* sp. near a creek-bed, Montalbion, Irvinebank, north Queensland, October 11, 1944 (R. V. Southcott) has the following data (in micra):

ASens	PSens	SBa	SBp	ISD	DS	Ta I	Ti I	Ge I	Ti I / Ta I
48	ca 83	17	22	137	20-35	156	236	225	1·513

These data do not differ significantly from those of the type series.

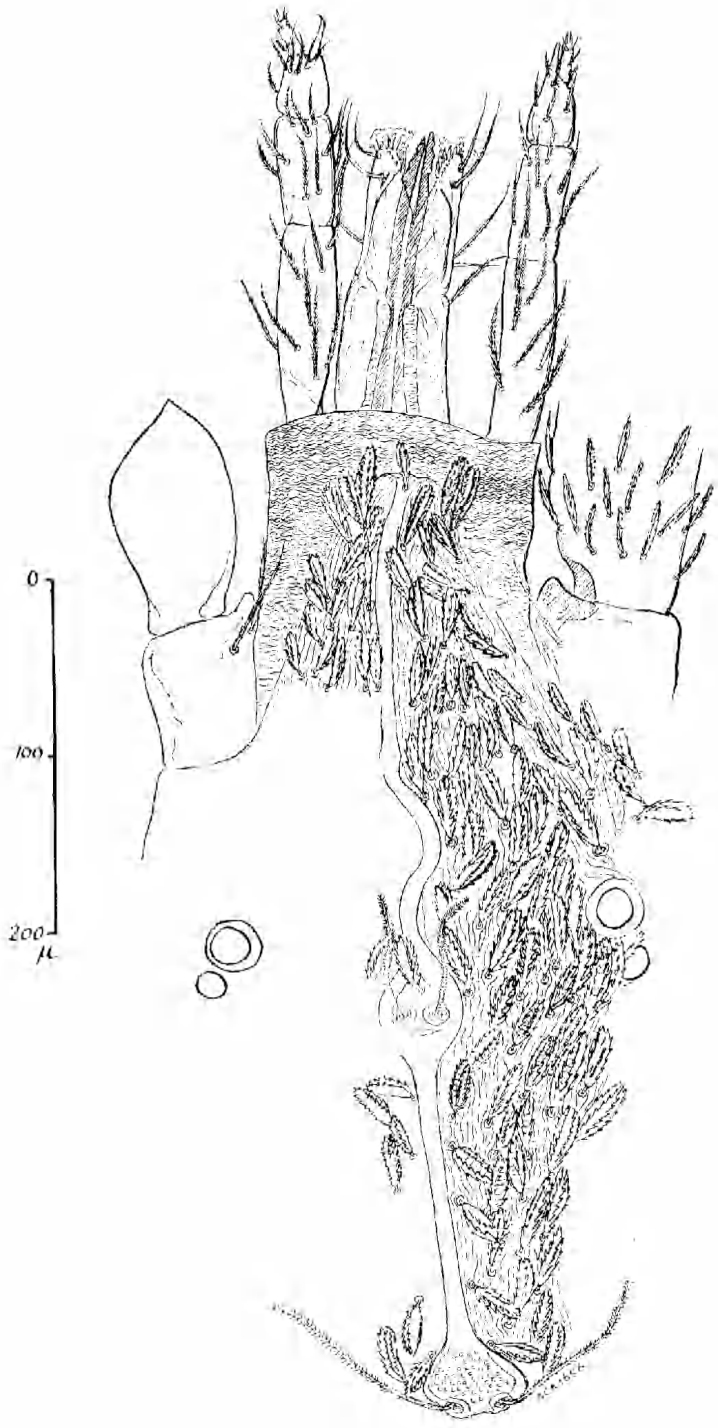

Fig. 21. *Fessonia serrata*, sp. nov. Adult male (holotype). Gnathosoma, crista, eyes and adjacent structures.

Remarks and Data of Three North American Specimens.

Three specimens, all adult female, are referred to *F. australiensis*, from North America. Locality and other collection data of these specimens are as follows:

ACA 1651, adult ♀, on garlic (dried), Apasco, G[uanajua]to., Mexico; at Laredo, Texas. C. P. Trotter, December 30, 1936. Lot 37-607, U.S.N.M. collection (potashed).

ACA 1653, adult ♀, on garlic, Apasco, G[uanajua]to., Mexico: at Laredo. February 7, 1937. C. P. Trotter, Lot No. 37-3792. U.S.N.M. collection. (Potashed, in poor condition.)

ACA 1661, adult ♀, on garbanzos (= chick-peas), Mexico, at Hidalgo, Texas. Williamson, collector. October 4, 1936. Lot 36-32424. This specimen contains one egg with a chitinized chorion, and measures 264μ by 150μ; however, the egg appears distorted and its transverse diameter may be estimated as ca 190μ; it is mounted in polyvinyl alcohol mountant. In South Australian Museum collection ex U.S.N.M. collection.

The metric data of these three specimens are as follow:

Specimen	ASens	PSens	SBa	SBp	ISD	DS	Ta I	Ti I	Ge I	Ti I / Ta I
ACA 1651	58	—	17	ca25	146	-32	157	245	259	1·561
ACA 1653	—	—	18	18	149	-32	146	217	232	1·486
							148	224	225	1·514
ACA 1661	52	77	18	22	162	17-30	158	234	243	1·481

Remarks and Data on Seven Specimens Originating from Asia.

Seven specimens have been examined which have originated from Asia, which are referred to *F. australiensis*. Locality and other collection data of these specimens are as follows:

ACA 1652, two specimens, one ♂, one ♀, in mixed grain and rice, India: at Boston, United States of America, October 27, 1937. O. A. Hardy. Boston No. 13572, Lot 37-24930. In United States National Museum collection. Potashed.

ACA 1751, Nymph. Slide labelled "Soil I. Thunia" [Burma], December 16, 1946. Name of collector not stated. In South Australian Museum collection.

ACA 1654 A, B, C. Three adult specimens, A ?sex, B ♀, C ?♂. On *Dioscorea* sp. China: at Honolulu, Hawaii, 1928. Identification number Hawaii #1916. U.S.N.M. collection. Remounted in methyl cellulose medium January 11, 1961. Specimen ACA 1654C retained in S.A.M. collection, others in U.S.N.M.

ACA 1715, one specimen, adult ♀, gravid. On *Sagittaria* sp.; China: at Honolulu, Hawaii, date not recorded. Identification Hawaii # 1628C. In South Australian Museum collection ex U.S.N.M. collection. The idiosoma of the mite contains about 30 developing eggs, these measuring about 195μ long by 165μ across, ellipsoidal.

The metric data of these specimens are as follow:

Specimen	Sex	Origin	ASens	PSens	SBa	SBp	ISD	DS	Ta I	Ti I	Ge I	Ti I / Ta I
ACA 1652A	♂	India	47	ca38	16	18	142	14-26	151	194	203	1·285
ACA 1652B	♀	India	47	—	17	17	148	14-27	140	184	203	1·314
ACA 1751	Nymph	Burma	—	43	12	17	100	16-32	101	154	144	1·525
ACA 1654A	?	China	—	—	ca20	20	194	-30	—	—	290	—
ACA 1654B	♀	China	54	—	19	24	213	-31	—	265	280	—
ACA 1654C	♂?	China	—	—	23	22	182	18-30	—	—	—	—
ACA 1715	♀	China	—	—	16	22	148	-28	150	224	230	1·493

Remarks on the Distribution and Variation of Fessonia australiensis.

Although specimens from three continents are referred here to *Fessonia australiensis*, the author does not consider it justified to make a further taxonomic division of them at present. The specimens from Australia, Mexico and India have almost identical dorsal idiosomalae, and the metric data tabulated give no firm indication of any differences. The specimens ascribed to eastern Asia (Burma and China at Hawaii) are more distinct in the character of the dorsal setae, which tend to be more distinctly ridged longitudinally, and are obtusely clavate rather than fusiform-lanceolate. However, in view of the poor state of the specimens and the incompleteness of the data associated with them, including locality, the author prefers to leave this question until more material and data (including possibly larval correlations) are available. It may be added that there appears nothing inherently improbable in a suggestion that smaridid mites may have been distributed by man in soil and plants within historical times. Such, if it has occurred, could modify considerably distributions depending on other more ancient or natural factors.

Fessonia lappacea sp. nov.

Figs. 22-25

Description of Adult Male (from Holotype ACA 1714) (Figs. 22 and 23).

Colour of mounted specimen reddish-brown. Animal of normal smaridid shape, somewhat robust, and with a short nasus. Idiosoma 920μ long to tip of nasus by 530μ wide where widest.

Crista normal for genus. Anterior end of crista expands into a Y-shaped piece which contains normal scobalae. The standard data of the holotype are:

ASens	PSens	SBa	SBp	ISD	DS
54	68	14	18	121	18-30

Anterior and posterior sensillae filiform, tapering, ciliated throughout their length; ciliations basally minute, lengthening over middle and distal parts.

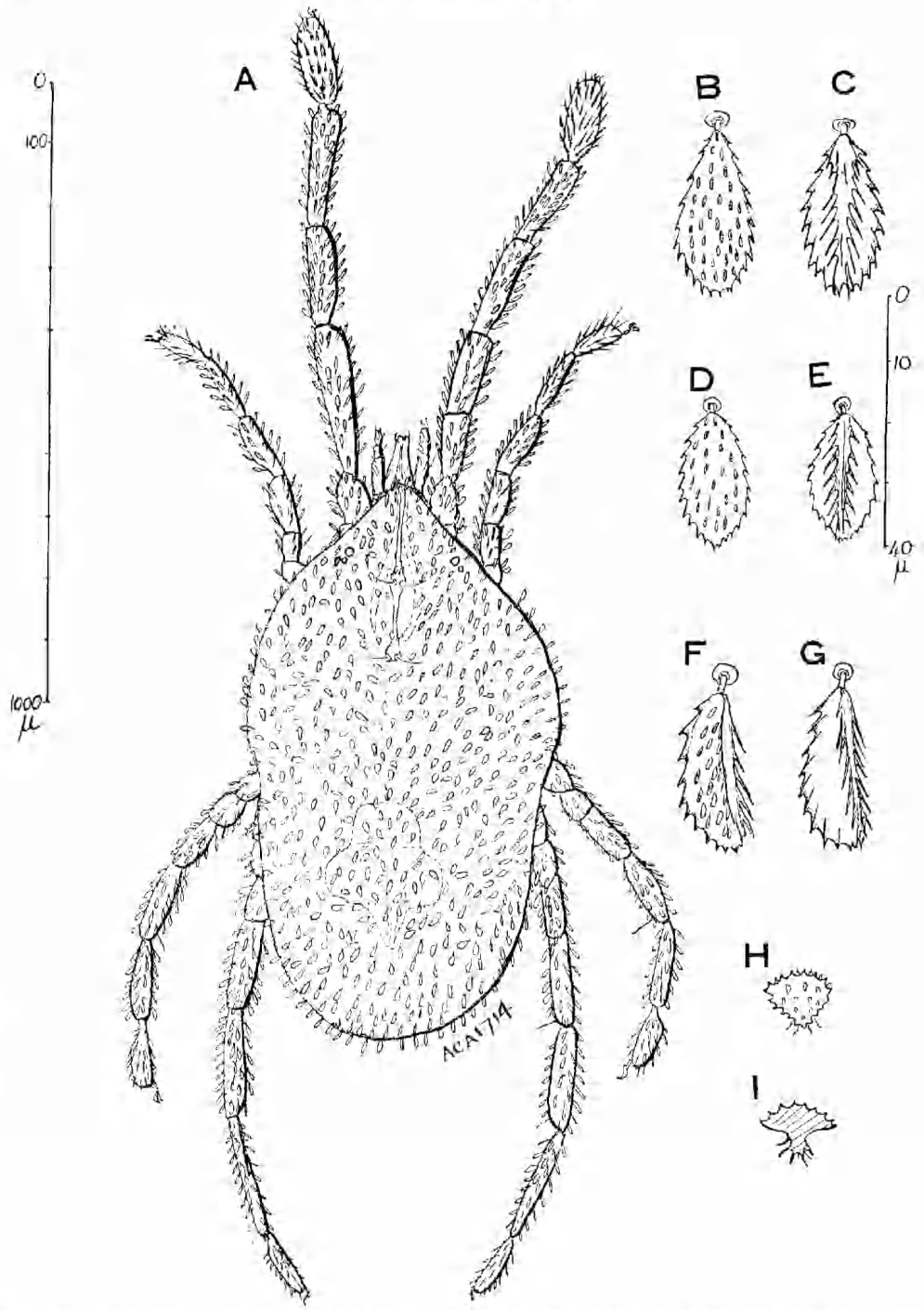

Fig. 22. *Fessonia lappacea*, sp. nov. Adult male (holotype). A, entire, dorsal view, to scale on left. B-I, views of dorsal idiosomal scobalae: B, dorsal view of a seta near posterior pole of idiosoma; C, ventral or carinal aspect of same seta; D, E, similar views of another more anterior seta; F, G, lateral views of setae; H, end view; I, optical cross-section of a seta. (All setae to scale on right.)

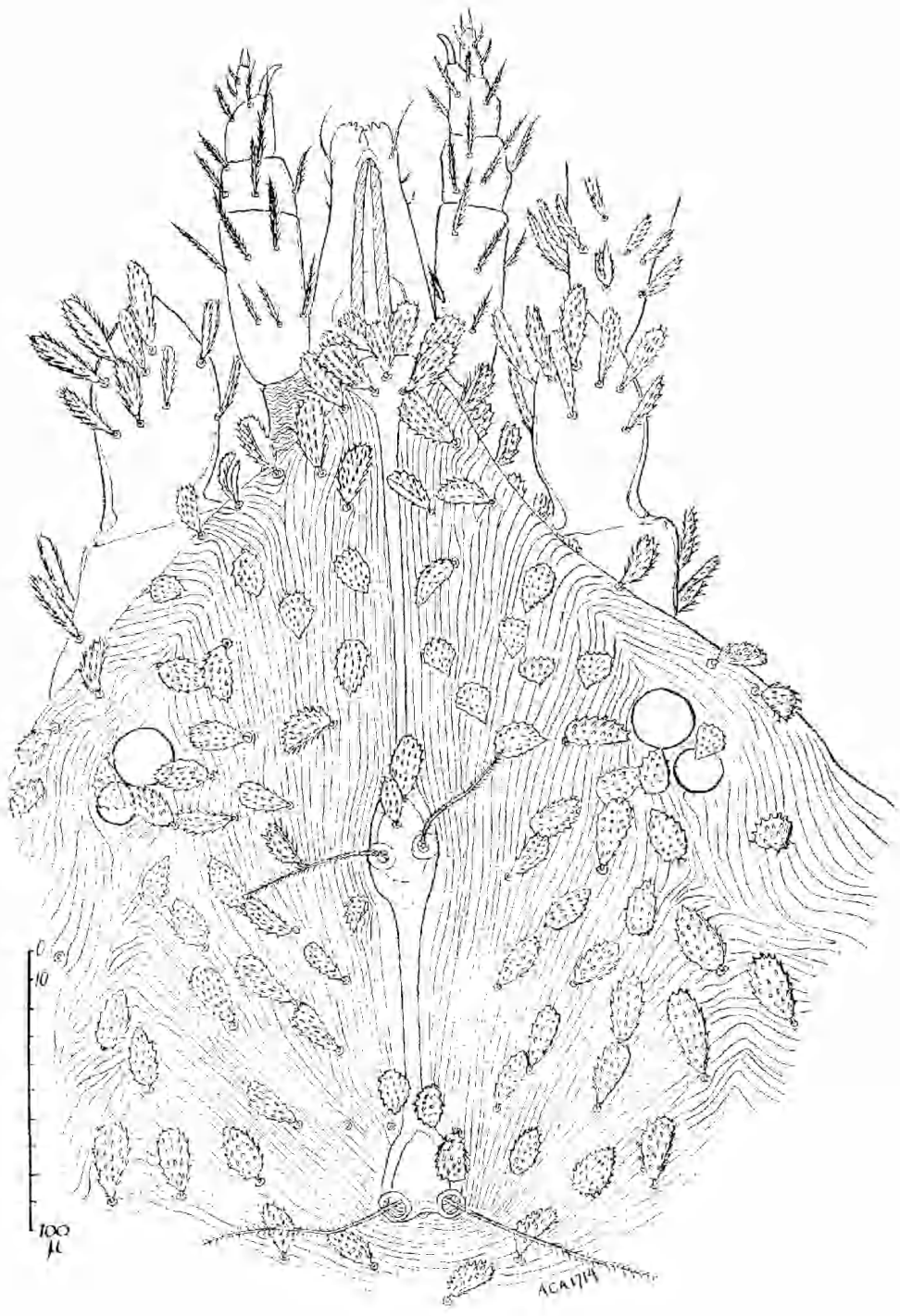

Fig. 23. *Fessonia lappacea*, sp. nov. Adult male (holotype). Dorsal view of propodosoma and adjacent structures.

Eyes placed normally, as figured (Fig. 23). Anterior eye 18μ across, circular, placed well anterior to anterior sensillae, posterior eye circular, 15μ across, posterolateral to anterior eye and a little anterior to the anterior sensillae.

Dorsal idiosomalae (scobalae), lanceolate or clavate, strongly spiculate, the spicules being projecting serrations, arranged in irregular rows or columns, with a maximum of 6-7 spicules in a row and a maximum of 10 in a column. Tectum setae convex, tectal angle about 120°. Carina and flange of scobala narrow, with long ciliations (see Fig. 22 B-I).

Venter appears normal, but is not clearly seen in the sole mount available. Internal genitalia of male type.

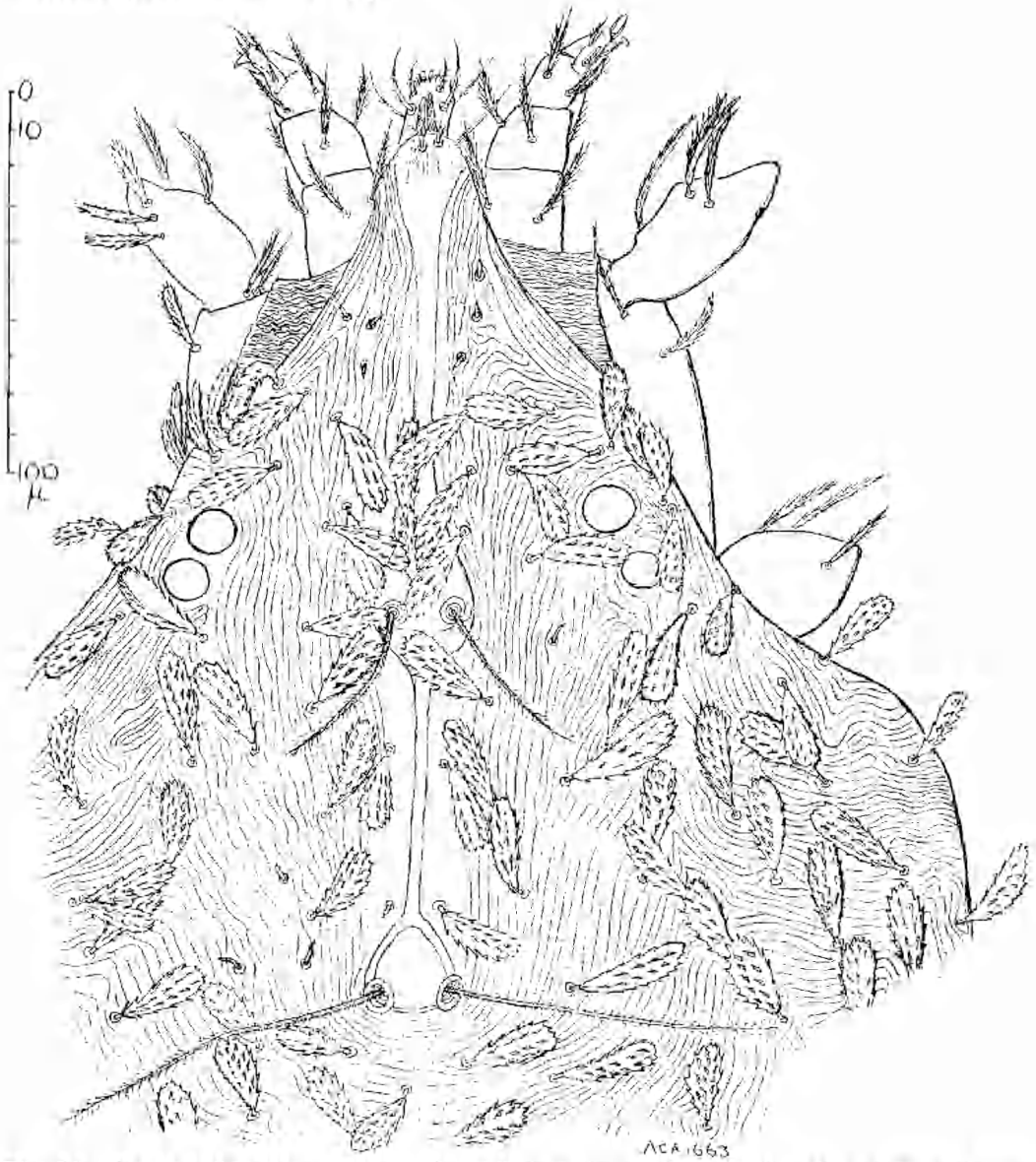

Fig. 24. *Fessonia lappacea*, sp. nov. Nymph (specimen ACA 1663). Dorsal view of propodosoma and adjacent structures (specimen a little compressed).

Legs robust. Leg lengths (including trochanter and tarsal claws): I 810μ, II 535μ, III 595μ, IV 805μ. Tarsus I 146μ long by 54μ high, tibia I 194μ long, genu I 178μ long, tarsus IV 106μ long by 34μ high, tibia IV 206μ long, genu IV 188μ long (tarsal lengths exclude pedicle and claws). Hence Ti I/Ta I = 1·329; Ti IV/Ta IV = 1·943.

Gnathosoma as figured. Palpi fairly robust, with comparatively robust ciliated scobalae, as figured (Fig. 23).

Description of Nymph (from Specimen ACA 1663) (*Figs.* 24 *and* 25).

Similar to adult but smaller and with more slender proportions; of the usual smaridid facies for a nymph. Idiosoma 565μ long, 290μ wide.

The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
ca 60	83	15	16	99	20-34

Sensillae characters as in adult.

Eyes similar to adult, anterior 12μ across, posterior 10μ across.

Dorsal idiosomalae (scobalae) similar to adult but of more elongate proportions and with somewhat fewer spicules.

Venter normal for nymph.

Legs: I 660μ long, II 395μ, III 407μ, IV 550μ (lengths include trochanter and tarsal claws). Tarsus I 105μ long by 36μ high, tibia I 163μ long, genu I 150μ long, tarsus IV 75μ long by 32μ high, tibia IV 115μ long, genu IV 122μ long (tarsal lengths exclude claws and pedicle). Tarsal claws ciliated obliquely along their sides except at tip.

Gnathosoma as figured (Fig. 24), similar to adult.

Material Examined. ACA 1659, adult ♂, Paratype, with orchid plants, Mexico [no further locality data]: at Brownsville, Texas, July 23, 1947. Lot 47-11431 (collector not stated). U.S.N.M. collection. (The idiosoma of this specimen contains a single median large guanine body (110μ across), the pos-

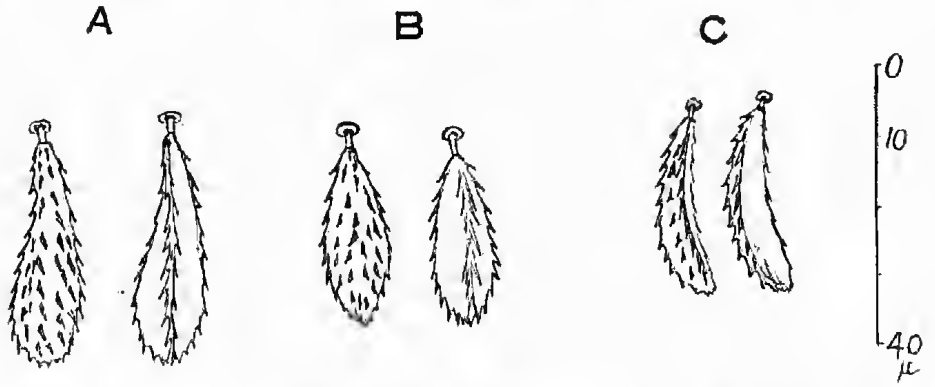

Fig. 25. *Fessonia lappacea*, sp. nov. Nymph (specimen ACA 1663). A-C, dorsal idiosomal scobalae: A, a longer seta seen in dorsal and ventral aspect; B, another seta, similar view; C, another seta, oblique lateral views (all to scale shown).

terior point of which is level with the anterior point of the chitinized male internal genital armature; so large a guanine body is somewhat unusual in smaridids; but see the comment on ACA 1660 below.)

ACA 1660, adult, ?sex, on cactus plant, S[an] L[uis] P[otosi], Mexico: at Laredo, Texas, January 9, 1946. S. H. Coleman, colr. Laredo 38119, Lot 46-4214. In U.S.N.M. (The idiosoma contains two large median guanine bodies, anterior 73μ across, posterior 50μ across.)

ACA 1662, two adults, Paratypes (one ♀, one ♂), same data as ACA 1659, retained in South Australian Museum collection ex U.S.N.M.

ACA 1663, nymph, labelled "*Neotoma fuscipes*, Monterey, California. Feb. 14, 1946. J. M. Linsdale, colr. No. 651. Lot 46-3641", U.S.N.M. ("Nymphotype").

ACA 1714, adult male, holotype, Batesburg, South Carolina, "In trash under holly bush (in woods), sifted out in lab.", April 1, 1911, E. A. M[cGregor]. Slide No. (A-VI 23 (2)). In United States National Museum.

ACA 1718 (identification somewhat dubious; poor mount), ?adult, Colonia, Hidalgo, [Mexico], June 27, 1943, F. Bonet (No. 740—'2 ej.'). South Australian Museum collection.

Remarks. See the remarks in Section IV of the present paper.

Fessonia scobina sp. nov.

Fig. 26

Description of Adult (?Sex) (from Holotype ACA 1657).

Colour in life not recorded. Of normal smaridid shape and dimensions, with a short nasus to idiosoma. Idiosoma 870μ long by 425μ wide where widest (on further compression, some days later, the idiosoma was 890μ long).

Crista normal, the anterior sensillae placed 173μ behind nasus, and just posterior to eyes. The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
ca 38	ca 70	16	18	125	20-42

Anterior sensillae slender, lightly ciliated throughout their length, ciliations longer in distal 2/3 of seta. Posterior sensillae similar.

Eyes 2 + 2, anterior the larger, 30μ across, posterior eye posterior and somewhat lateral to anterior eye, 20μ across.

Dorsal idiosomalae (scobalae) lanceolate, blunted terminally, with a convex tectum and tectal angle of about 180°, tectal spicules about 50 in number, small, fairly uniform in character, rounded in dorsal view, but in lateral view short and triangular, arranged evenly and hence on some setae tending to form columns, rows, or oblique lines, over the tectum; the proximal spicules slightly longer than the distal. Carina and flange narrow, with long strong ciliations. The dorsal scobalae tend to elongate posteriorly upon the dorsum.

Venter not clearly visible in the sole specimen available.

Legs normal. Leg lengths (including trochanter to tips of tarsal claws): I 950μ, II 530μ, III 630μ, IV 790μ. Tarsus I 155μ long by 55μ across, tibia I 210μ

long, genu I 215μ long, tarsus IV 117μ long by 28μ high, tibia IV 185μ long, genu IV 195μ long (tarsal lengths exclude claws and pedicle). Tarsal claws normal, ciliated obliquely along sides except at tip.

Gnathosoma appears normal, but is not clear enough for figuring in the mount.

Material Examined. The sole specimen seen is the holotype, ACA 1657, "On orchid plants, Chilpancingo [de los Bravos], G[uerre]ro., Mexico: at Laredo,

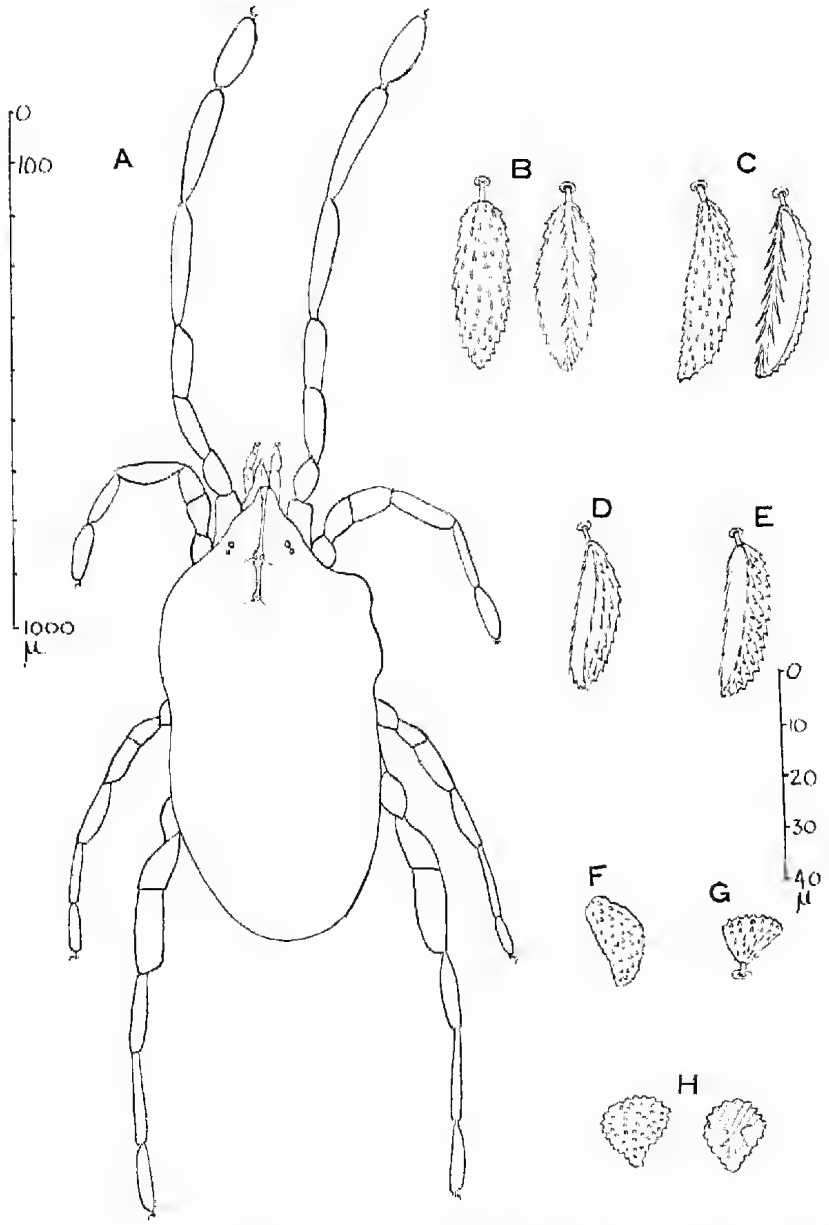

Fig. 26. *Fessonia scobina*, sp. nov. Adult (?sex), holotype. A, dorsal view, entire, setae mostly omitted, to scale on left. B-H, various views of individual dorsal setae (scobalae) (all setae to scale shown).

Aug. 29, 1946. Talbert, colr. Lot 46-14352". In United States National Museum collection.

The type was originally mounted in a polyvinyl alcohol medium. In January, 1961, the author remounted it into methyl cellulose medium, but in this process the swelling of the polyvinyl medium has damaged the specimen, making some features unsuitable for description and figuring; the figures of the legs are to some extent reconstructed.

Remarks. This species is nearest to *F. lappacea* and *F. lacrimosa*, but may be separated as in the key given earlier.

Fessonia lacrimosa sp. nov.

Figs. 1 L, M, 27 and 28

Description of Adult Male (from Holotype ACA 1655).

Colour in life not recorded. Of normal smaridid dimensions and shape, with a short nasus. Idiosoma 1186μ long to tip of nasus by 735μ wide (the holotype has been compressed by the mounting).

Crista normal, the anterior sensillae placed 188μ behind nasus and just posterior to eyes. The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
—	—	14	20	132	24-42

Sensillae missing in holotype preparation.

Eyes 2 + 2, anterior the larger, 20μ across, posterior 12μ across, placed a little lateral to the anterior eye.

Dorsal idiosomalae (scobalae) with tectum lanceolate or fusiform, to slightly clavate. Spicules mostly 30-35 in number on tectum, tending to be more elongate basally (and there about 2·6μ long by 1μ wide in dorsal view, appearing as an isosceles triangle with apex pointing proximally; in profile about 1·5μ high), forming wedge-like serrations, which are arranged into fairly regular columns of up to about 10 or 11 spicules but less regular rows. Carina narrow with long somewhat adpressed ciliations. Posterior dorsal setae more elongate, to 42μ long.

Venter not clearly seen in the preparation. Internal genitalia have normal male character.

Legs normal. Leg lengths (including trochanter and to tarsal claw-tips): I 955μ, II 620μ, III 610μ, IV 855μ. Tarsus I 153μ long by 46μ high, tibia I 224μ long, genu I 221μ long, tarsus IV 105μ long by 32μ high, tibia IV 185μ long, genu IV 195μ long (tarsal measurements exclude claws and pedicle). Tarsal claws normal, ciliated obliquely along their sides except at tip.

Gnathosoma as figured (Fig. 28) the dorsal palpal scobalae ciliated and with the tectum setae somewhat expanded.

Material Examined. This species is known from only the holotype male, ACA 1655 (2 slides, A and B), labelled "On orchid plants, Tamazunchale, S[an]

L[uis] P[otosi], Mexico: at Brownsville [, Texas]. Aug. 28, 1947. Lot 47-13151", name of collector not stated. In United States National Museum collection. Specimen originally mounted in polyvinyl alcohol mountant; remounted in methyl cellulose medium January 11, 1961, by author.

Remarks. See the remarks for *F. scobina*, above.

Subfamily HISTIOSOMATINAE Southcott

For definition and synonymy see Southcott, 1961*a*, p. 442.

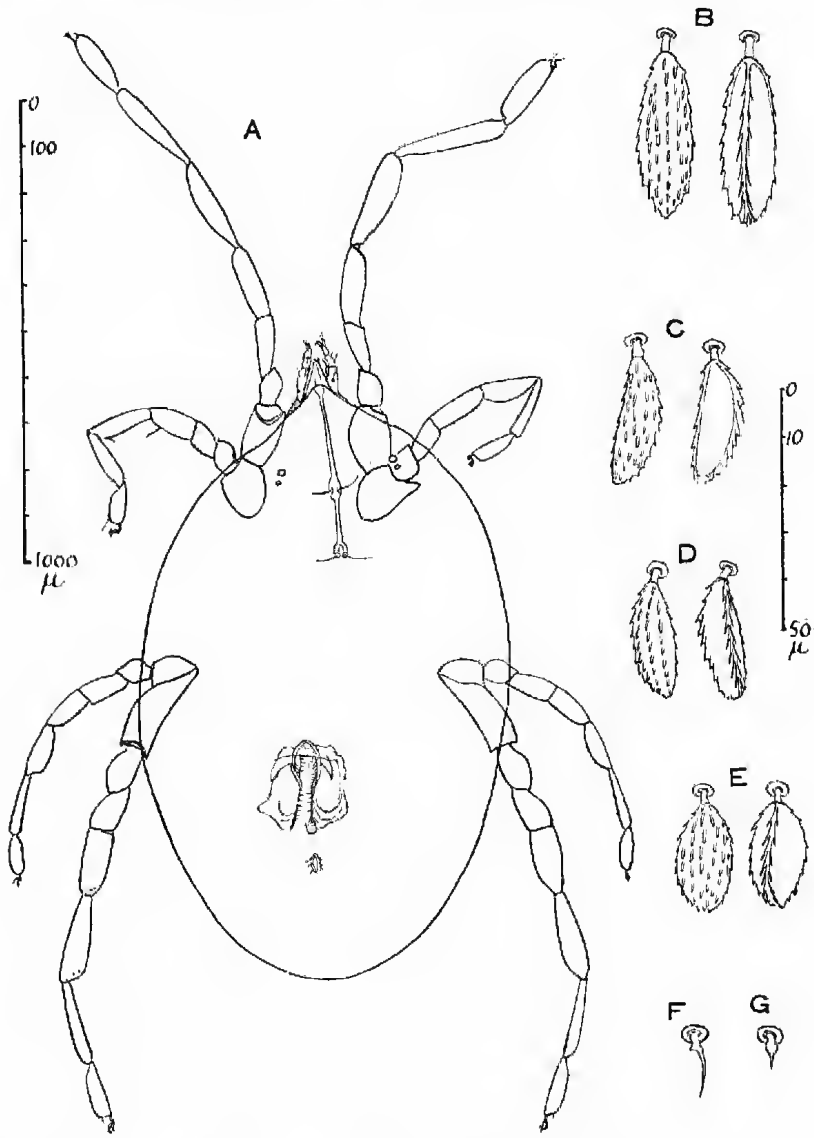

Fig. 27. *Fessonia lacrimosa*, sp. nov. Adult male (holotype). A, dorsal view, in transparency, setae mostly omitted, to scale on left. B-G, various aspects of individual dorsal idiosomalae (scobalae); F and G each show the annulus and pedicle only, the scobillum having been stripped away by swelling of the polyvinyl alcohol medium on remounting (all setae to scale on right).

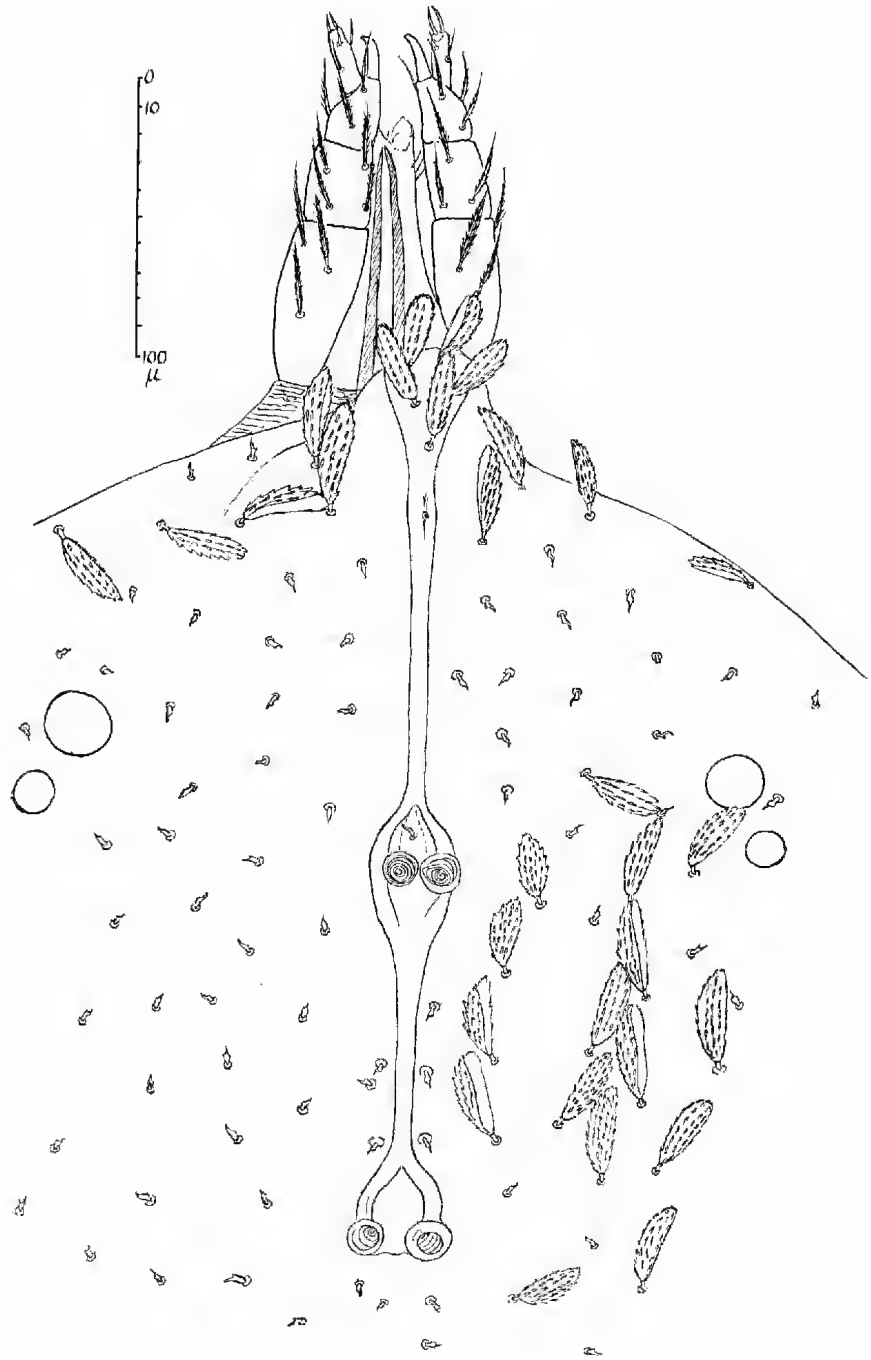

Fig. 28. *Fessonia lacrimosa*, sp. nov. Adult male (holotype). Dorsal view of propodosoma and gnathosoma. Remounting from polyvinyl acid medium has caused the loss of the sensillary setae, and has stripped away the scobillum from the dorsal scobala in many instances, leaving only the pedicle arising from the annulus.

Remarks. The Hirstiosomatinae have hitherto been considered as containing the post-larval genera *Hirstiosoma* Womersley, 1934, and *Sphaerotarsus* Womersley, 1936 (see Southcott, 1961*a*, p. 443). In that paper the author referred the described North American Hirstiosomatinae to *Hirstiosoma*. In the present study of a number of North and Central American Hirstiosomatinae one species is referred to *Hirstiosoma*, but the remainder are referred to two new genera, *Trichosmaris*, gen. nov., and *Clavismaris*, gen. nov. *Trichosmaris* is the commonest hirstiosomatine genus in the collections studied from North and Central America, and to it are referred specimens that have been described in the literature.

Key to the Genera of Adults and Nymphs of Hirstiosomatinae of the World

1. Whole or part of posterior sensillary setae of crista thread-like, tapering, and in the thread-like part ciliations are minute or absent. Tarsus IV of male normal. 2

   Posterior sensillary setae of crista, clavate, ciliated 3

2(1). Posterior sensillae of crista gradually tapering, thread-like, with ciliations minute or absent *Hirstiosoma* Womersley, 1934

   Posterior sensilla of crista consist of two elements, a proximal stronger ciliated parallel-sided or slightly expanded part (pars clavata or "clavum") to which a distal part or flagellum is joined, more or less abruptly. The flagellum is filiform, tapering, simple, of about the same length as the pars clavata. Tarsus IV of male normal *Trichosmaris*, gen. nov.

3(1). Tarsus IV of male greatly enlarged
Sphaerotarsus Womersley, 1936 (Australia)

   Tarsus IV of male normal
Clavismaris, gen. nov. (North and Central America)

Genus HIRSTIOSOMA Womersley

Definition—see Southcott, 1961*a*, p. 443.

Remarks. Only one species of Hirstiosomatinae from North and Central America is now referred to this genus, *H. bolivari*, sp. nov., described below. Previously *Smaris longilinealis* Ewing, 1909, was placed in *Hirstiosoma* by Baker and Wharton (1952, p. 243), and doubtfully by Southcott (1961*a*, p. 443). This species is regarded by the author as of somewhat doubtful status, and is discussed elsewhere in the present paper; possibly it belong to *Trichosmaris*, gen. nov. *Smaris longilinealis* Ewing, 1910, is quite another species, and is possibly a species of *Fessonia* (see the discussion later).

Hirstiosoma bolivari sp. nov.

Figs. 29 and 30

Description of Adult, ♀ (*from Holotype Specimen, ACA* 1723).

Colour in life not recorded. Animal of normal smaridid shape, rather elongate, with a normal nasus. Idiosoma 1680μ long by 825μ wide where widest.

Crista elongate, with two sensillary areas. Anterior sensillary area has two ciliated slightly clavate sensillae and carries also upon the nasus 22 scobalae

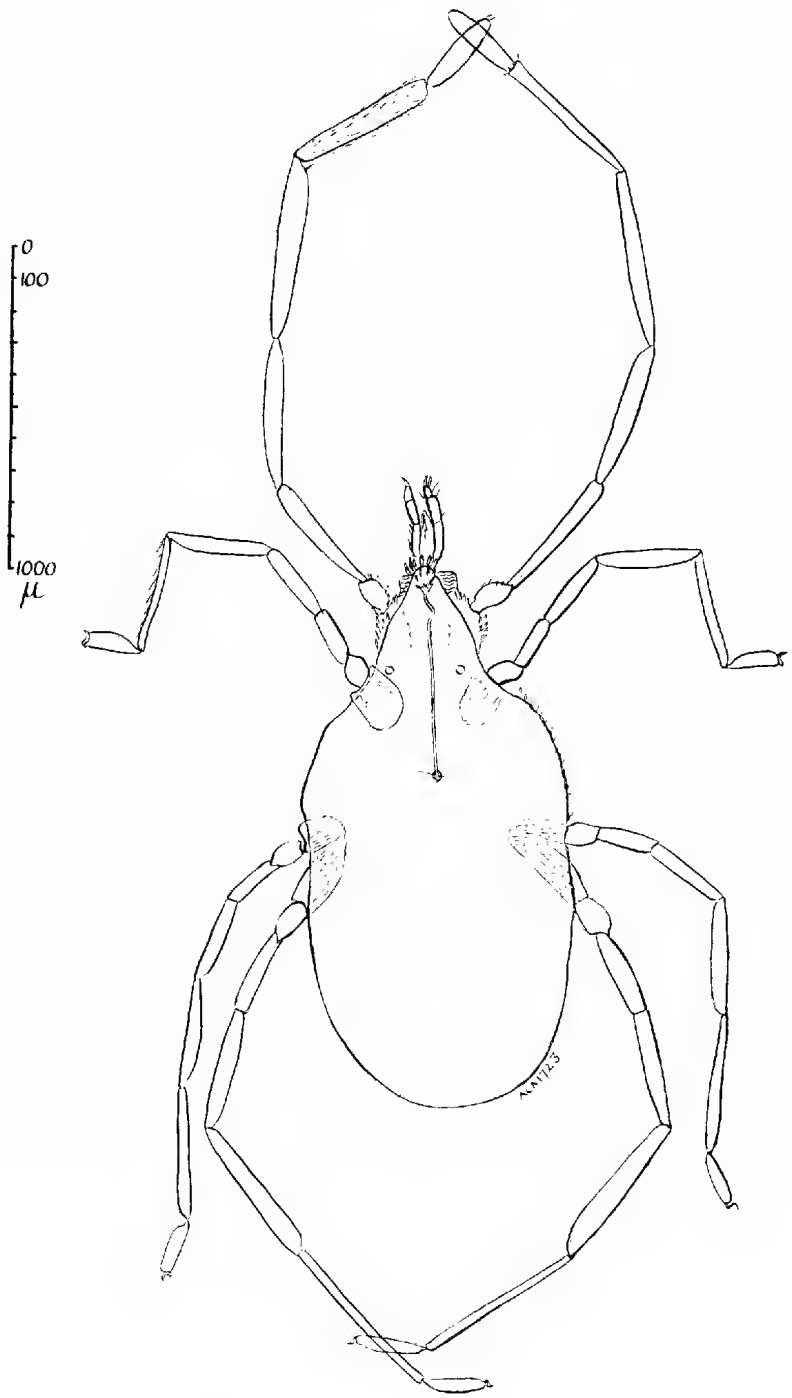

Fig. 29. *Hirstiosoma bolivari*, sp. nov. Adult (holotype). Dorsal view, in transparency, setae mostly omitted.

32-41μ long. Posterior sensillary area with two tapering filiform sensillae, seen to be faintly ciliated proximally when examined under oil immersion. The crista tapers to a point 58μ posterior to centres of posterior sensillae.

The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
54	ca 115	18	24	577	22-40

Eyes one on each side, circular, cornea 43μ across; eyes placed 14μ anterior to mid-point of ISD (OAS = 275μ; OPS = 302μ) (OAS + OPS = ISD).

Dorsal idiosomal scobalae typically smaridid. The tectum setae is excavated to a canoe form, of which the "gunwhale" is thickened with spicules along its inner and outer edges (see Fig. 30 C, D). The carinal flange tends to turn up and become complex along its borders; carinal borders with small serrations. In the more posterior setae the tectal borders are widened and the subtectum tends to form a gutter along each side of the seta. From above the dorsal seta is more or less triangular in outline, the outline being made up of the carinal flanges. The setae are almost unpigmented. Each seta arises from a papilla (see Fig. 30 E-G).

Ventral surface not clearly seen in the holotype, but appears normal.

Legs long; lengths (including trochanter to tips of tarsal claws): I 2315μ, II 1450μ, III 1560μ, IV 2080μ. Tarsus I 278μ long by 68μ across, tibia I 483μ long, genu I 570μ long, tarsus IV 232μ long by 47μ high, tibia IV 568μ long, genu IV 498μ long (tarsi measured without claws and pedicle). Hence the following ratios hold:

tarsus I/tibia I	tibia I/genu I	tarsus IV/tibia IV	tibia IV/genu IV
·5756	·8474	·4085	1·141

Setae of legs normal for Smaridídae, tending to elongate.

Gnathosoma with normal armilla. Palpi with pointed slender scobalae, tapering, lightly and adnately ciliated. Tip of mouth-cone as figured, with its setae simple or almost so.

Locality. The species is known only from the holotype, adult, ♀, specimen ACA 1723, Palmira, Cuernavaca, Mor[elos], Mexico, May 14, 1943, C. Bolivar, per F. M. Bonet (without serial number), in South Australian Museum collection.

Remarks. This species is readily distinguishable from other described members of the genus on the character of the dorsal idiosomal scobalae. No other species has been described in which the tectum setae is canoe-like. By the key of Womersley and Southcott (1941, p. 73) for the Australasian forms *H. bolivari* keys down to *H. scalare* Womersley, 1934, from which, however, it may be separated by the character of the tectum setae, the much longer legs, the presence of only adnate ciliations on the dorsal palpal scobalae, the longer DS (22-40μ as against 16-24μ) and other characters.

The dorsal idiosomal scobalae of *H. bolivari* resemble those of the described members of *Trichosmaris*, gen. nov. If, however, in a specimen the posterior sensillae were lost it would still be possible to distinguish *H. bolivari* from *Trichosmaris* spp. on the more elongate characters of its legs and on the significantly lower tarsus I/tibia I ratio (0·58 as against 0·69-0·76).

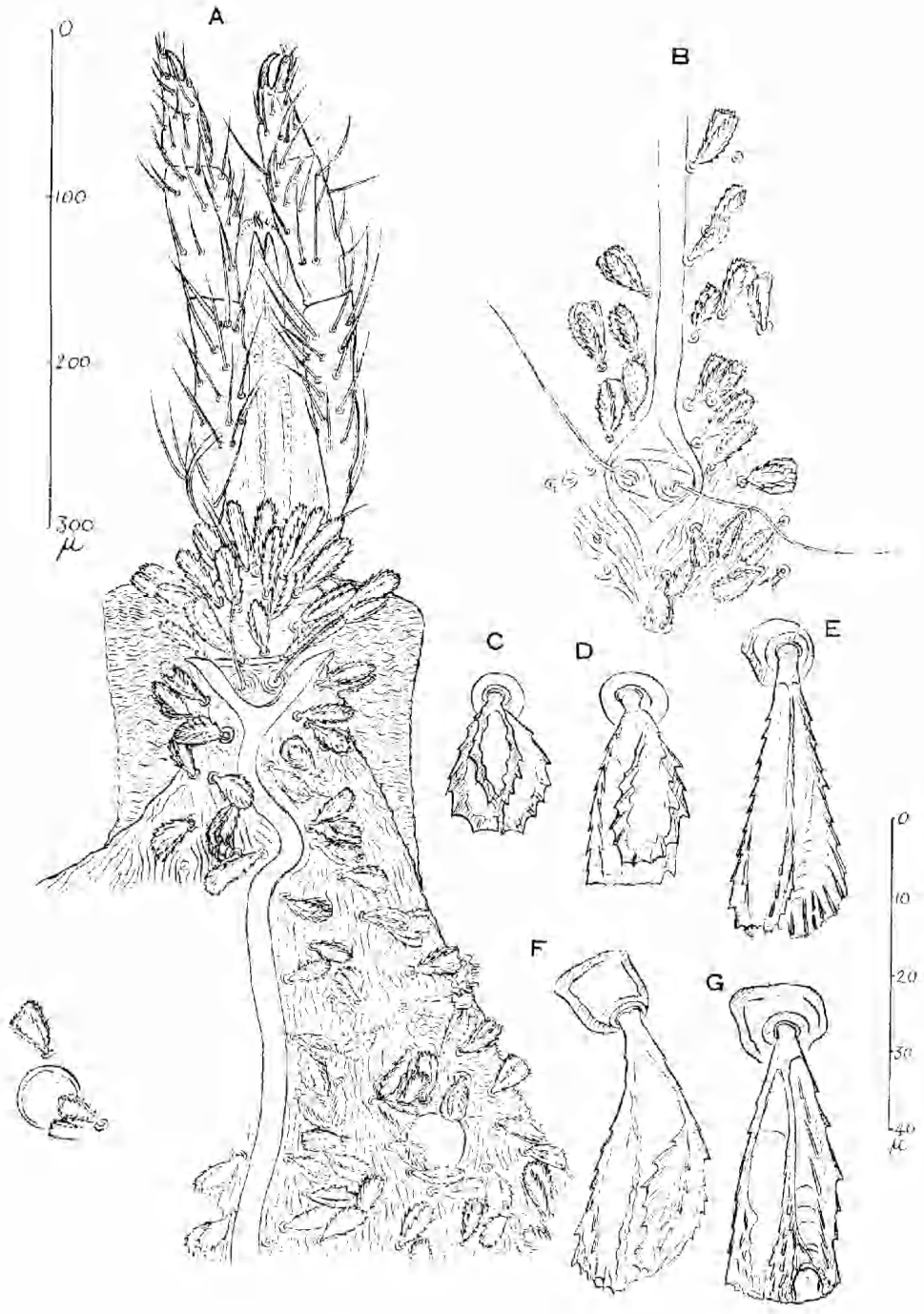

Fig. 30. *Hirstiosoma bolivari*, sp. nov. Adult (holotype). A, propodosoma and gnathosoma, dorsal view. B, posterior part of crista. C-G, various individual dorsal idiosomalae; C, D, setae laterally placed on dorsum above leg III; E-G, setae from posterior pole of idiosoma. (A, B to scale on left; C-G to scale on right.)

The undulations figured in the anterior part of the crista are possibly an artefact of mounting in the polyvinyl alcohol medium used; no attempt has been made to correct for this apparent shortening in the measurements given.

Genus TRICHOSMARIS, gen. nov.

Type species: *Trichosmaris dispar*, sp. nov.

Definition. Adult and nymph: One eye on each side placed about the level of the middle of the crista. Crista present, normal, linear, with anterior and posterior sensillary areas. Anterior sensillary area placed at anterior pole of idiosoma dorsally. Anterior sensillae ciliated, somewhat clavate. Posterior sensillary area at posterior end of crista, well in front of middle of idiosoma dorsally. Posterior sensillae consist of a proximal ciliated part, which expands slightly, from the end of which arises a long tapering filiform simple thread, of a length comparable with the proximal part of the sensilla. Leg tarsi of male normal, not markedly expanded or globular. (Larva not known.)

Remarks. (1) *Trichosmaris*, gen. nov., occupies somewhat of an intermediate position between *Hirstiosoma* Womersley, 1934, and *Sphaerotarsus*, Womersley, 1936.

Trichosmaris dispar sp. nov.

Figs. 31-34

Description of Adult Female (from Mounted Holotype Specimen ACA 1724) (Figs. 31 and 32).

Colour in life not recorded. Animal of normal smaridid shape, with a normal nasus. Idiosoma 1460μ long by 1005μ wide where widest (the specimen has the appearance of having been compressed during the mounting and it is considered these figures are somewhat greater than obtained during life).

Crista as recorded for genus, with two sensillary areas: anterior sensillary area placed in the fork of the dividing anterior end of the crista, and carries, besides the anterior sensillae, 18 scobalae similar to the other dorsal idiosomal scobalae, but more elongate, 28-34μ long: anterior sensillae clavate, ciliated throughout their length, with ciliations small basally but longer distally and forming a spindle-like brush around the distal part of the sensilla; posterior sensillary area with PSens as defined for genus, the proximal ciliated part or pars clavata expands only a little after its middle, then narrows again to a point, the ciliations distally on the pars clavata a little longer, pars clavata 57μ long, and from its distal end arises the flagellum, a filiform unciliated tapering thread, about 55μ long (its extremity is very delicate and very hard to discern even with the oil immersion), thus making a total length of ca 112μ.

The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
45	ca 112*	14	21	402	14-28**

*Pars ciliata 57μ, flagellum ca 55μ (see text).

**Excludes, as is customary, the scobalae of the nasus (= anterior sensillary area for this genus, etc.).

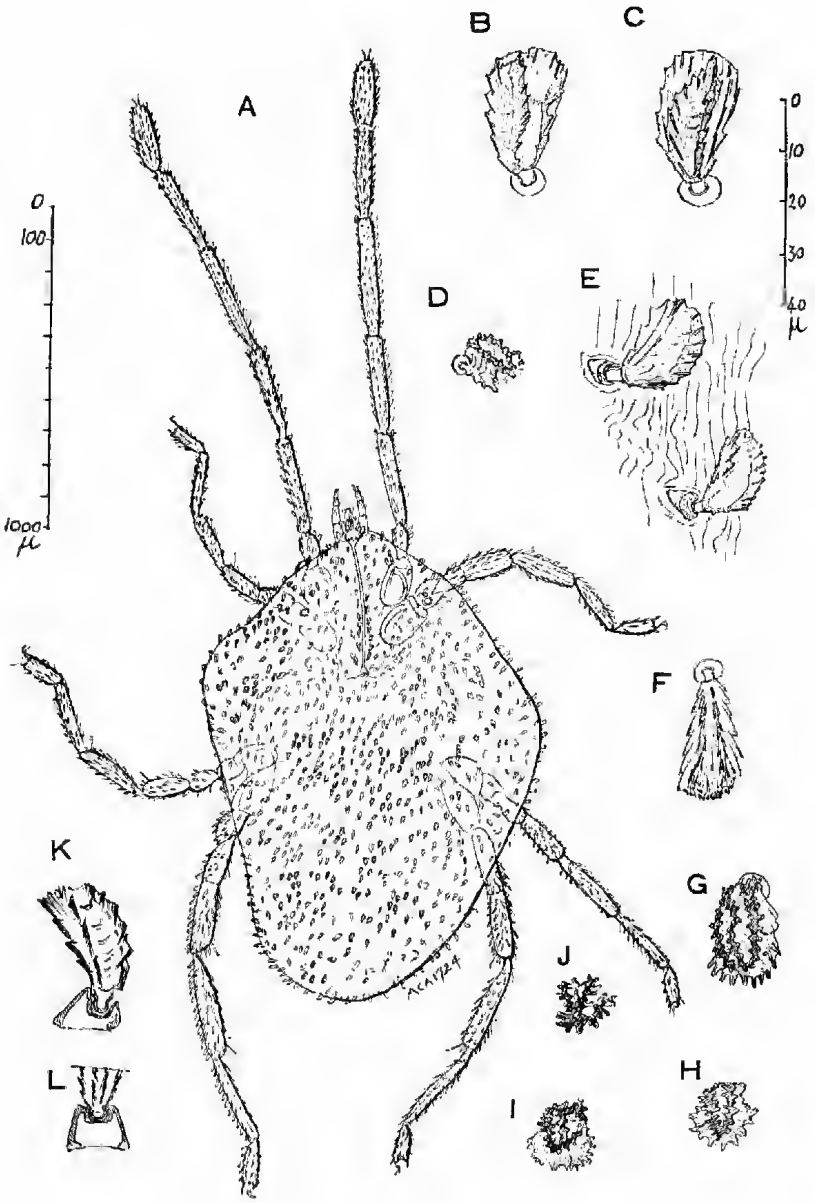

Fig. 31. *Trichosmaris dispar*, sp. nov. A-E, K, L, adult female (holotype), from Nebraska. A, dorsal view, entire, seen somewhat as a transparency; the idiosoma is compressed and distorted. B-E, dorsal idiosomal scobalae, in various views. F-J, aspects of dorsal idiosomal scobalae of another specimen, number ACA 1679, from North Carolina; F, dorsal aspect; G, oblique end view; H-J, end views. K, L, views of dorsal idiosomal scobalae of holotype, to show details of papilla (amphora). (All setae to scale on right.)

Eyes one on each side, circular, cornea 28μ across; eyes placed a little anterior to middle of crista. Distance OAS = 180μ, OPS = 222μ (OAS + OPS = ISD; the ISD is considered as divided by a line running transversely between the eye centres). Eyes fairly close to lateral margin of idiosoma, in dorsal view.

Dorsal idiosomal scobalae typically smaridid in character. The tectum setae is widened and canoe-like, the "gunwhale" along each side a double row of spicules. In lateral view each of these spicules is long and strong, running obliquely along the side of the seta or "subtectum". The setae are brown, uniformly and lightly pigmented. In lateral aspect the setae are almost semicircular, with the dorsal and ventral outlines broken by "saw-teeth". The carinal flange is broad and each lateral edge is cut into 3 or 4 coarse saw-teeth. From above, the seta is fan-shaped or roughly triangular, with a convex but serrated edge, the outline being made up of the expanded carinal flanges, the outline of the tectum setae superimposes itself on the edges of the carinal flanges only basally (see e.g. Fig. 31C). In end view of the scobala the tectum setae is seen to be deeply excavated, hence canoe-like. In addition, the scobala has a well-marked central cavity. Each seta arises from a chitinized papilla which is an expanded amphora setae (see Fig. 31K, L and compare with e.g. Fig. 1C). The dorsal setae are somewhat longer toward the posterior pole of the idiosoma. Over most of the dorsum the scobalae project anteriorly (this may be a distinct feature in smaridids), and only at the periphery of the opisthosoma, in dorsal view, do they project posteriorly.

Ventral surface normal. External genitalia 205μ long by 50μ across the closed external lips. The innermost row of setae (labialae) pointed, strongly ciliated basally. Internal genitalia with light chitinization and 4 rounded or ovoid lobes about 40μ long by 30μ wide; these contrast with the more heavily chitinized armature and two lobes forming a horseshoe of the smaridid male internal genital armature. Anus 75μ long, anal setae (analae) spindle-like, with long ciliations. The venter carries normal ventral setation; the scobalae are similar to the dorsal scobalae over ventral opisthosoma, but around the external genitalia, and more anteriorly are spindle-like heavily ciliated setae, normal for smaridid ventralae; around the anus (outside the group of analae) the ventralae are of intermediate character.

Legs normal. Leg lengths (inclusive of trochanter and tarsal claws): I 1570μ, II 900μ, III 995μ, IV 1290μ. Tarsus I 210μ long by 75μ across, tibia I 295μ long; genu I 382μ long, tarsus IV 142μ long by 46μ high, tibia IV 320μ long, genu IV 332μ long (tarsal measurements exclude claws and pedicle). Setae of legs appear to be normal for Smarididae; the proximal scobopedalae similar to idiosomalae, then becoming longer, more pointed and ciliated distally. On tarsal scobalae the spicules are strong and pointed and arranged in regular rows. Among the scobopedalae are various sensalae. Many fine spinalae are present on the telofemora to the tibiae. Tibia I with dorsodistal (somewhat posterior) vestigiala, genu I with dorsodistal neomedian vestigiala (other vestigialae not visible in holotype preparation). Tarsal claws normal, ciliated obliquely along their sides except terminally.

Gnathosoma with the normal armilla. Palpi with pointed scobalae, lightly ciliated with adnate ciliations, as well as the palpal tibial sensalae. There are no expanded palpal scobalae. The tip of the mouth-cone has a hypostomal lip as figured, and various prominent pointed setae as figured (Fig. 32), these setae being adnately ciliated.

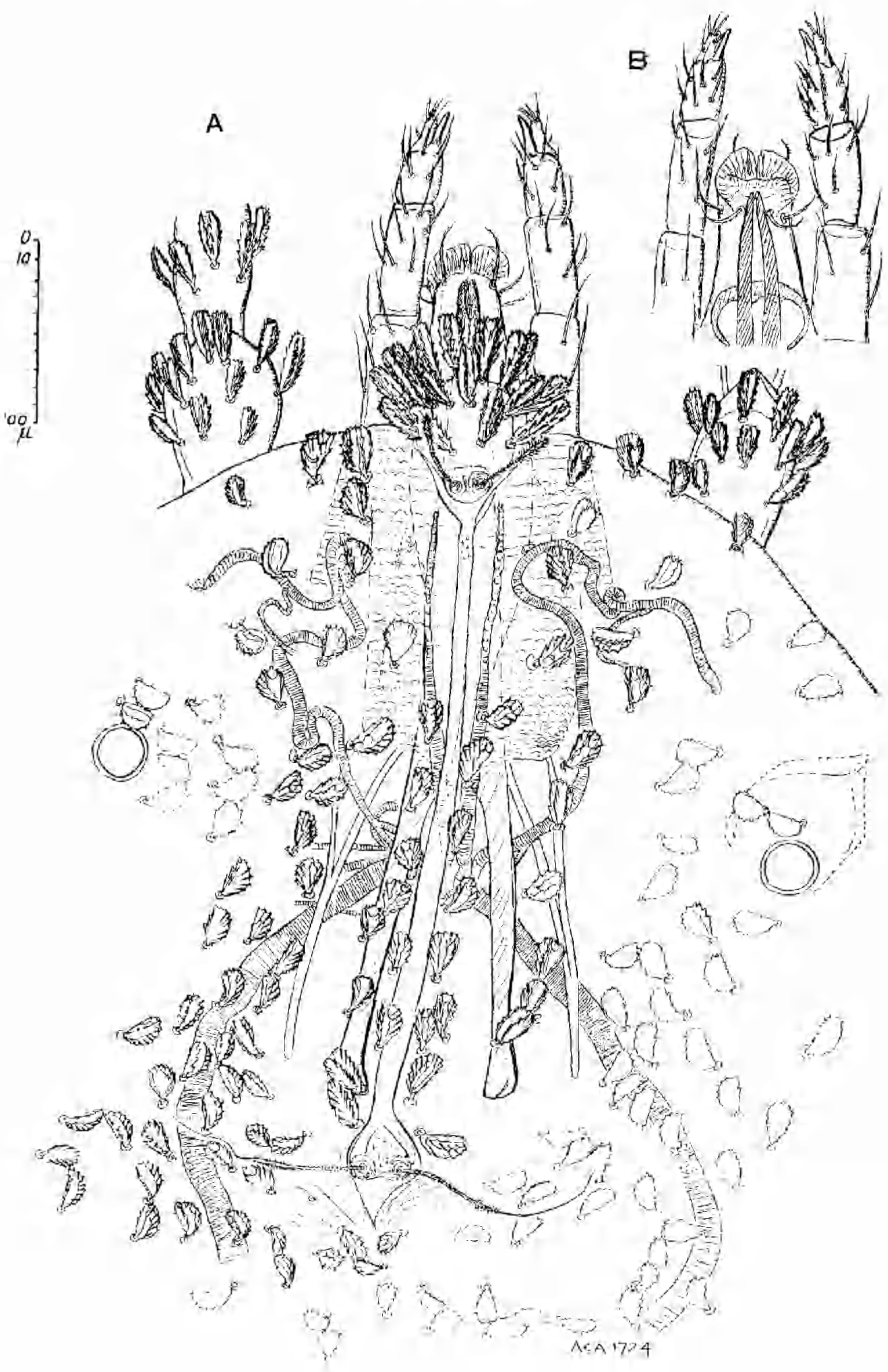

Fig. 32. *Trichosmaris dispar*, sp. nov. Adult female (holotype). A, anterior part of idiosoma in dorsal view, and some adjacent and underlying structures. Some setae indicated in outline only. B, gnathosoma, ventral aspect.

Description of Nymph (from ACA 1700) (Figs. 33 and 34).

Colour in life not recorded. Character in general similar to the adult female described, with normal smaridid shape. Idiosoma 710μ long by 425μ wide where widest. Crista and sensillae similar to adult female, also eyes. The standard data are as follow:

ASens	PSens	SBa	SBp	ISD	DS
28	ca 71*	10	14	243	16-26

*pars clavata 38, flagellum ca 33.

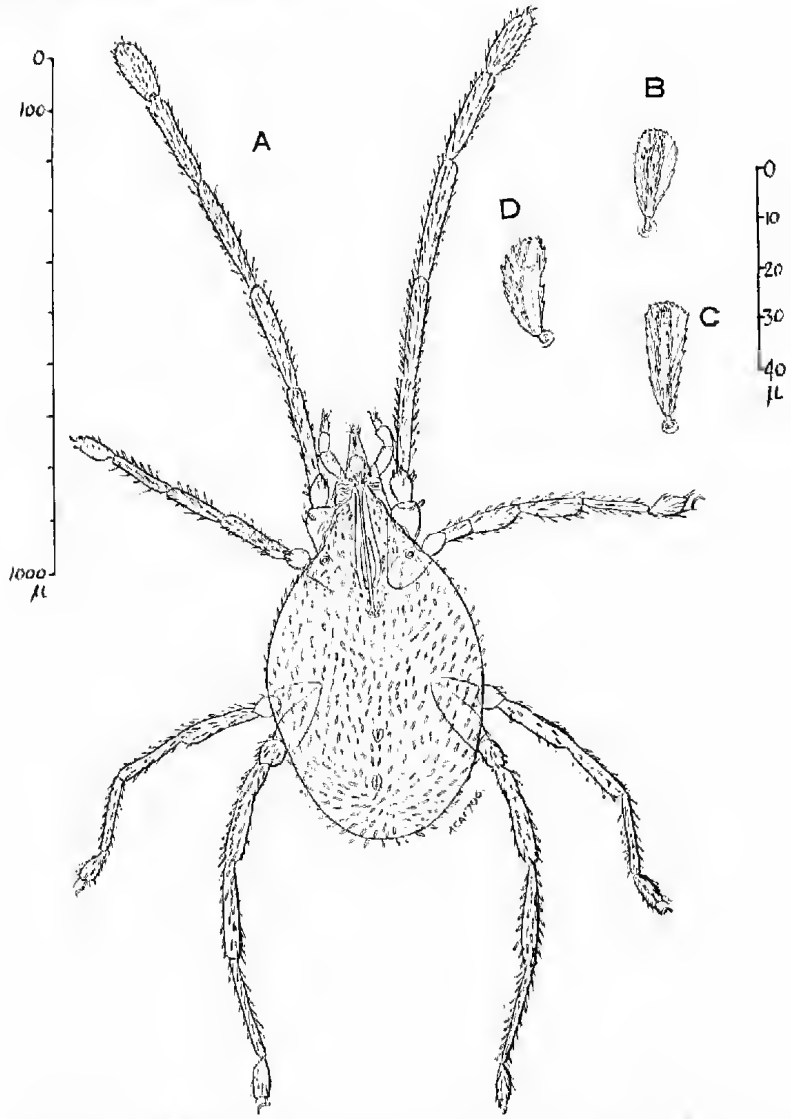

Fig. 33. *Trichosmaris dispar*, sp. nov. Nymph (specimen ACA 1700). A, entire, dorsal view, but also showing some ventral features; to scale on left. B-D, various aspects of dorsal idiosomal scobalae, to scale on right.

Dorsal idiosomal scobalae similar to those of adult female.

Ventral surface normal. External genitalia typical, an occluded urvulva with its median raphe present.

Legs normal. Leg lengths (inclusive of trochanter and tarsal claws): I 1025μ, II 565μ, III 620μ, IV 800μ. Tarsus I 133μ long by 54μ across, tibia I 194μ long, genu I 245μ long, tarsus IV 85μ long by 30μ high, tibia IV 203μ long, genu IV 203μ long. Leg setae similar to adult. Tarsal claws similar to adult.

Gnathosoma as figured (Fig. 34), similar to adult.

Material Examined. Specimens referred to this species (*T. dispar* f.p.) are as follows (adults unless otherwise stated):

United States National Museum Specimens

ACA 1675, Oxford, Miss[ouri], Sept., 1905, collector not stated, but label in writing of H. E. Ewing.

ACA 1676, ♀. North Beach, Maryland, Sept. 21, 1919, under dead limb of tree on ground, H. E. Ewing.

ACA 1677, Chesapeake Beach (North Beach), Maryland, December 19, 1920, 'in leaf mold', H. E. Ewing, retained in South Australian Museum collection.

ACA 1678, Brooksville, Florida, W. T. Owrey, Feb. 18, 1924 ('No. 260').

ACA 1679, two specimens (one adult, one nymph), Raleigh, North Carolina, Nov. 8, 1937, Brimley and Wray, [by] sifting decid[uous] woods.

ACA 1680, two adults, in soil, Savannah, Georgia, July 13, 1944, H. K. Gouck, Bish. 17564, Lot 44-17554, retained in South Australian Museum collection.

ACA 1681, Urbana, Illinois, "I. O. P. 10. 10. 44 Snow", Lot 45-9367.

ACA 1682, on orchids, El Monte. Tam[auli]p[a]s, Mexico: at Laredo [, Texas], 1 Jan., 1945, Chapman, colr. Laredo 35276. Lot 45-1571.

ACA 1683, on *Cattleya* sp., Mante, Tamps., Mexico: at Laredo [, Texas], 16 April, 1945. H. R. Cary, Laredo 36267. Lot 45-6985.

ACA 1684, ♂, on orchid plants, Mexico: at Laredo, 29 Dec., 1945. Cary, Chapman, colrs. Laredo 37960. Lot 46-541. (Retained in S.A. Museum collection, ex U.S.N.M.)

ACA 1685, on orchid plants, Mexico: at Brownsville [Texas], 14 Nov., 1946. Lot 46-18740. No collector named. Retained in South Australian Museum collection, ex U.S.N.M.

ACA 1686, on orchid plants, Maiz, S[an] L[uis] P[otosi], Mexico: at Laredo, 12 Nov., 1946, Fouts, colr. Lot 46-18314.

ACA 1687, same source, 19 Dec., 1946. Jackson-Walton, colrs., Lot 47-699, retained in South Australian Museum collection, ex U.S.N.M.

ACA 1688, ♀, on orchid plants C[iuda]d del Maíz, S. L. P., Mexico: at Laredo, 14 Jan., 1947, Leary-Fouts, colrs. Laredo 42262, Lot 47-1091.

ACA 1689, on orchid plants, Tamazunchale, S. L. P.: at Laredo, 3 Feb., 1947, Jackson *et al.*, colrs. Lot 47-2504, retained in South Australian Museum collection.

ACA 1691, on *Laelia majalis*, Antiguo[-]Morelos, Mexico: at Brownsville, 18 March, 1947. Lot 47-4105. No collector named.

ACA 1692 and ACA 1693 each with same data as ACA 1691, retained for South Australian Museum collection, ex U.S.N.M.

ACA 1694, on orchid plants, Maiz, S. L. P., Mexico: at Laredo, 18 March, 1947, Jackson, colr., Lot 47-4249.

ACA 1695, same data, 18 March, 1947, Cary, colr., Lot 47-4247.

ACA 1696, on orchid plant, Guatemala, at Brownsville, 23 March, 1947, Allen, colr. Lot 47-4566.

ACA 1697, on orchid plants, Maiz, S. L. P., Mexico: at Laredo, 28 March, 1947, Ostrem, colr. Lot 47-5303, retained for South Australian Museum collection, ex U.S.N.M.

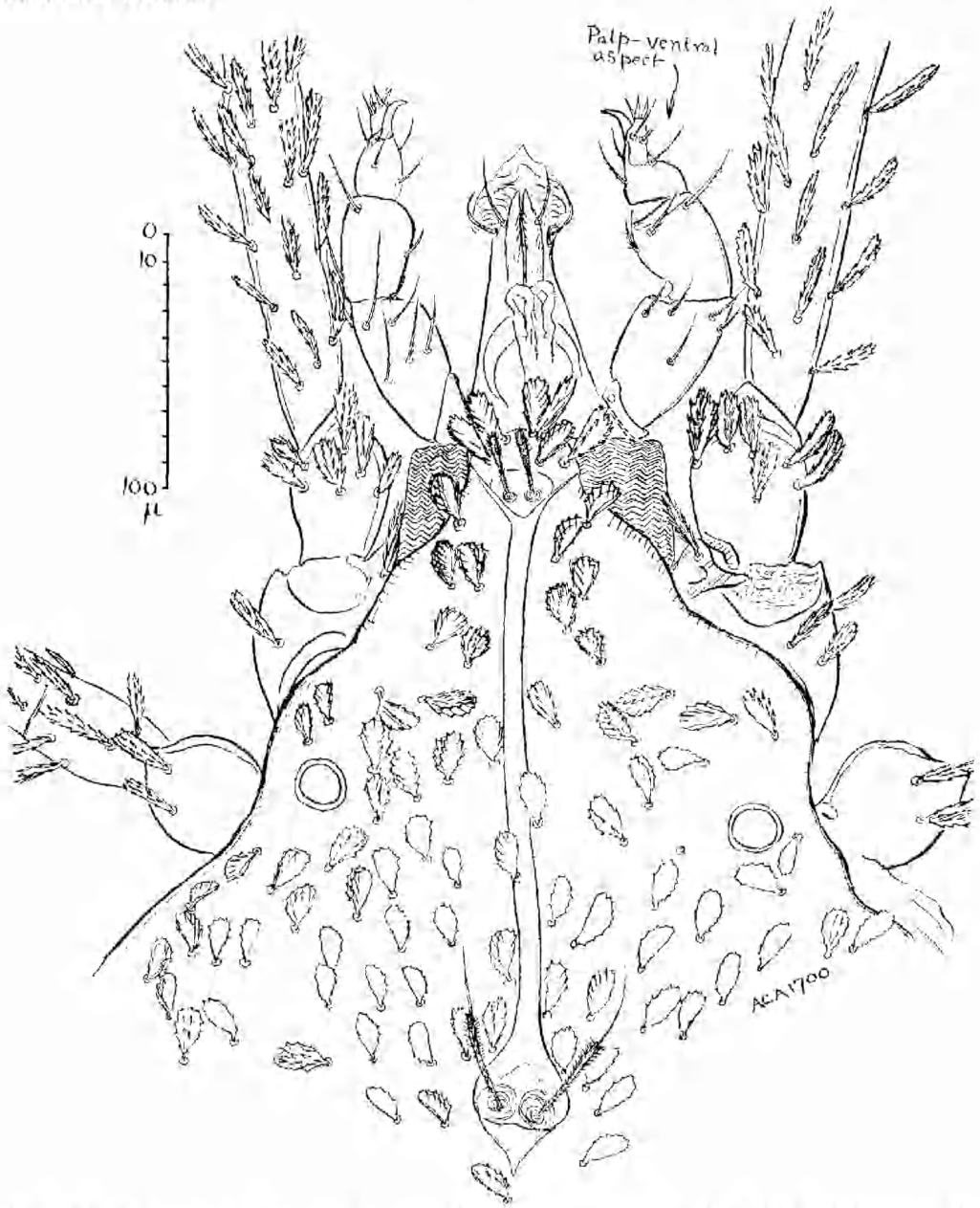

Fig. 34. *Trichosmaris dispar*, sp. nov. Nymph (specimen ACA 1700). Anterior part of idiosoma in dorsal view, and some adjacent structures (ventral view of palp shown on right).

ACA 1698, two specimens (one adult, one nymph), Maiz, S. L. P., Mexico: at Laredo, 28 March, 1947. Chapman-Jackson, colrs. Lot 47-5293.

ACA 1699, on orchid plants, Maiz, S. L. P., Mexico: at Laredo, 1 April, 1947, Cary-Leary, colrs. Lot 47-5307.

ACA 1700, nymph ("Nymphotype" of present paper), on *Laelia majalis*, Antiguo[-]Morelos, Mexico: at Brownsville, 2 April, 1947. No collector named. Lot 47-4992. In U.S.N.M. collection.

ACA 1701, same source, 23 April, 1947, Lot 47-5985 (slide marked in pencil "*Sphaerotarsus longilinealis* (Ewing), for size, O. K. ♂ type" (?in writing of Edward W. Baker). The specimen is a large one, with the idiosoma 1710μ long by 1030μ across in the somewhat compressed slide mount. Ewing (1909, p. 62) gives the type specimen of *longilinealis* as 1·68 mm. long and 1·00 mm. broad. The sex of specimen ACA 1701 cannot be determined in this slide mount, as the idiosoma is too opaque. For further comment on the possible synonymy of *longilinealis* Ewing see later in the present article.

ACA 1702, on orchid plants, San Luis Potosi, Mexico: at Laredo, 23 April, 1947 Cary *et al.*, colrs. Lot 47-6355.

ACA 1703 with same data as ACA 1702; retained for South Australian Museum collection, ex U.S.N.M.

ACA 1704, on *Laelia majalis*, Antiguo[-]Morelos, Mexico: at Brownsville, 23 April, 1947. Lot 47-5985. Collector not named. The specimen has only one PSens, which lacks a flagellum. However, the dorsal idiosomalae are quite typical, and the specimen is referred confidently to this species.

ACA 1705, two adults, with orchid plants, Maiz, S. L. P., Mexico: at Laredo, 6 May, 1947, Fouts, colr. Lot 47-6835.

ACA 1706, with *Laelia anceps*, Maiz, S. L. P., Mexico: at Laredo, 19 May, 1947. Leary, Cary, Fouts, colrs. Lot 47-7436. (Retained in South Australian Museum collection, ex U.S.N.M. collection.)

ACA 1708, ♂, North Beach, Maryland, 21 Sept., 1919, under dead leaves, H. E. Ewing (slide notation 'Berlese [funnel? No.] 1945').

ACA 1752, ♂, Ames, Iowa, September 11, 1909, under bark, H. E. Ewing. U.S.N.M. No. 20231. "Cotype." Specimen identified as *Smaris longilinealis* Ewing by Ewing and labelled in Ewing's writing. The slide label indicates also that the original mounting medium was gl[ycerine] j[elly] + ac[etic acid?]. The mite had been remounted in polyvinyl alcohol medium before receipt (in 1961) by the present author, and the mite had received some damage in loss of setae, but only of a minor nature. The sensillary setae have been detached from their sockets but remain near them. The specimen is conspecific with *T. dispar*.

For further discussion on the significance of this specimen see the remarks later in this article. Specimen in United States National Museum.

Department of Health, State of Nebraska. Specimens

(forwarded by William F. Rapp, Jr.)

ACA 1724, ♀, Table Rock, Pawnee Co., Nebraska, in humus, 3 Nov., 1954, W. F. Rapp, Jr., No. 54193 (Holotype specimen, to be deposited in the collection of the United States National Museum).

ACA 1725, ♂, data as ACA 1724, No. 54195, to U.S.N.M.

ACA 1726, ♂, data as ACA 1724, No. 54169; returned to collector.

ACA 1727, ♀, Leggett, Texas, 9 Feb., 1956, 'Ex duff'*; deposited in U.S.N.M.

ACA 1728, ♀, West Point, Cuming Co., Nebraska, 6 May, 1957, W. F. Rapp, Jr., ex humus (no serial number); returned to collector.

ACA 1729, ♀, Table Rock, Pawnee Co., Nebraska, 27 Dec., 1957, W. F. Rapp, Jr., ex oak humus. (Retained for South Australian Museum collection.)

ACA 1730, ♂, data as ACA 1727. (Retained for South Australian Museum collection.)

Remarks on Systematics. See later in this article.

Trichosmaris dispar subsp. **dentella** subsp. nov.

Figs. 35 and 36

Description of Adult Female (from Holotype Specimen ACA 1707)

Colour in life not recorded. Animal of normal smaridid shape. Idiosoma 1230μ long by 650μ wide where widest. Anterior sensillae similar to those of *T. dispar dispar* (in addition, there is a teratological third sensilla present, 15μ long, as figured in Fig. 36. See remarks made subsequently). Posterior sensillae normal for genus, somewhat obscured in the sole specimen available from an underlying opacity (guanine body). The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
44L, 38R	76 pars clavata + ca 60 flagellum = ca 136 total	26*	ca 20	489	18-36

*teratological

Eyes circular, normal, cornea 34μ across. Distance OAS 210μ, OPS 278μ.

Dorsal idiosomalae similar to those of *T. dispar dispar*, but longer, stronger, the tectum comparatively more elongate, with about 6 serrations along each side; the serrations and spicules of the seta are more prominent, including the serrations of the carinal flange. Dorsal setae longer towards posterior pole of idiosoma.

Ventral surface normal. External genitalia normal. Anus and anal setae as in *T. dispar dispar*.

* Mr. Rapp (pers. comm., 15 iii 1962) has explained that the term 'duff' means decaying vegetable matter under conifers, while 'humus' is used for decaying vegetable matter under deciduous trees, following the usage of his former teacher in ecology, Dr. Victor E. Shelford. Professor J. A. Prescott (pers. comm., 17 v 1962) has commented further that the term 'duff' "was introduced into the nomenclature of humus in 1931 by Lars-Gunnar Romell and S. A. Heiberg for North American forest soils as an extension of the Scandinavian classification and as a substitute for 'raw humus'. Romell was uncertain already in 1932 whether the term would survive. It refers more particularly to the still fibrous humus layers in both coniferous and broad leaved forests. The more decomposed humus is referred to as 'mull'. The range of properties is indicated in the descriptions as:

Crumb mull	Root duff
Grain mull	Leaf duff
Twin mull	Greasy duff
Detritus mull	Fibrous duff."

Legs normal. Leg lengths (inclusive of trochanter and tarsal claws): I (incomplete, 1585μ except tarsus I, missing), II 1052μ, III 1210μ, IV 1590μ. Tarsus I missing, tibia I 370μ long, genu I 475μ long, tarsus IV 170μ long by 56μ high, tibia IV 422μ long, genu IV 410μ long (tarsal length excludes claws and pedicle). Tarsal claws normal. Setation of legs similar to *T. dispar dispar*, but the scobalae longer and with more pointed ciliations.

Gnathosoma normal, as figured. Palpal scobalae lightly adnately ciliated, the tectum not expanded. Palpal tibial claw with flexor tooth. Palpal tarsus with normal sensalae.

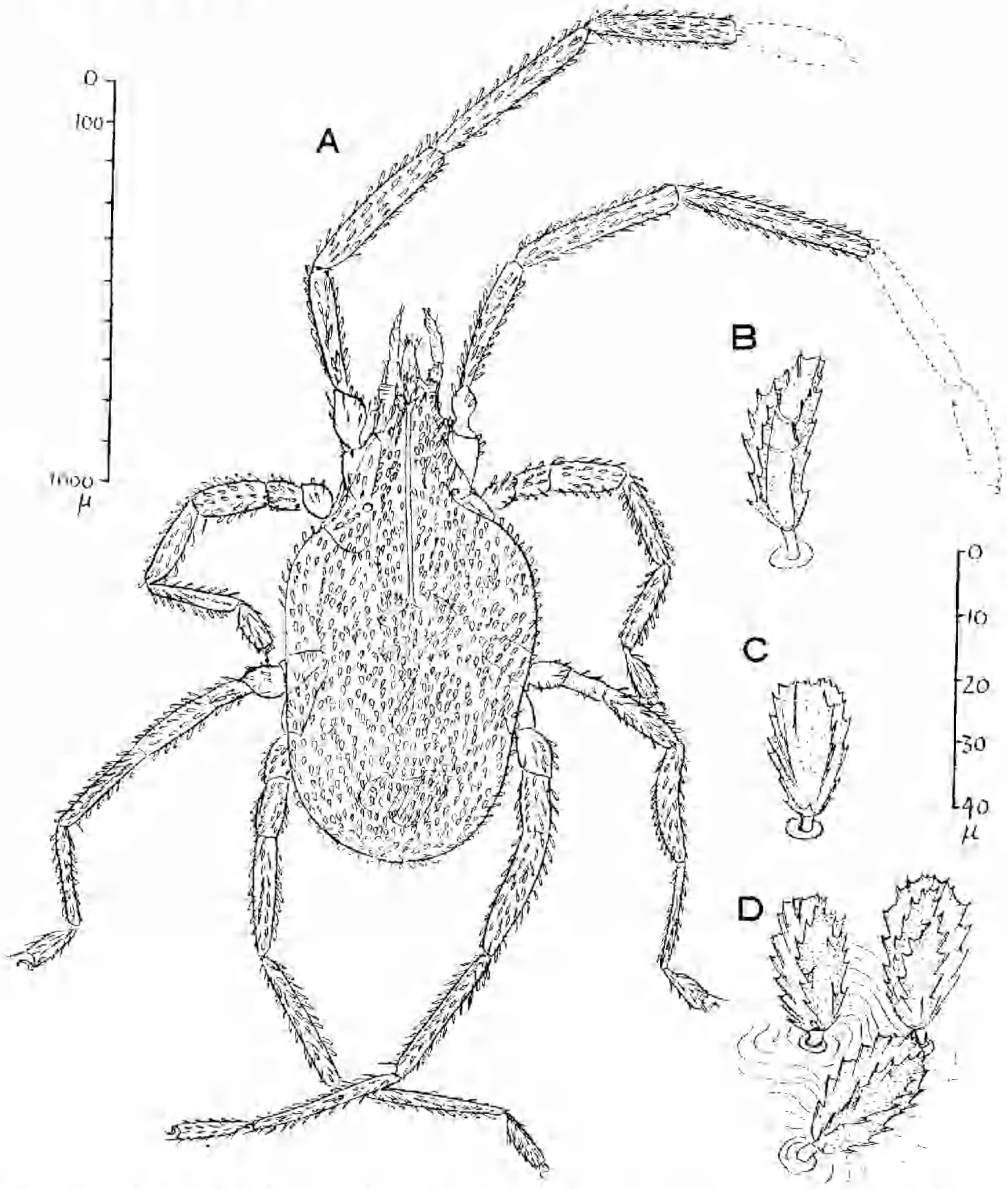

Fig. 35. *Trichosmaris dispar*, subsp. *dentella*, subsp. nov. Adult female (holotype). A, dorsal view of the slide mount (some ventral features shown in transparency), to scale on left. B-D, dorsal idiosomal scobalae, various aspects (to scale on right).

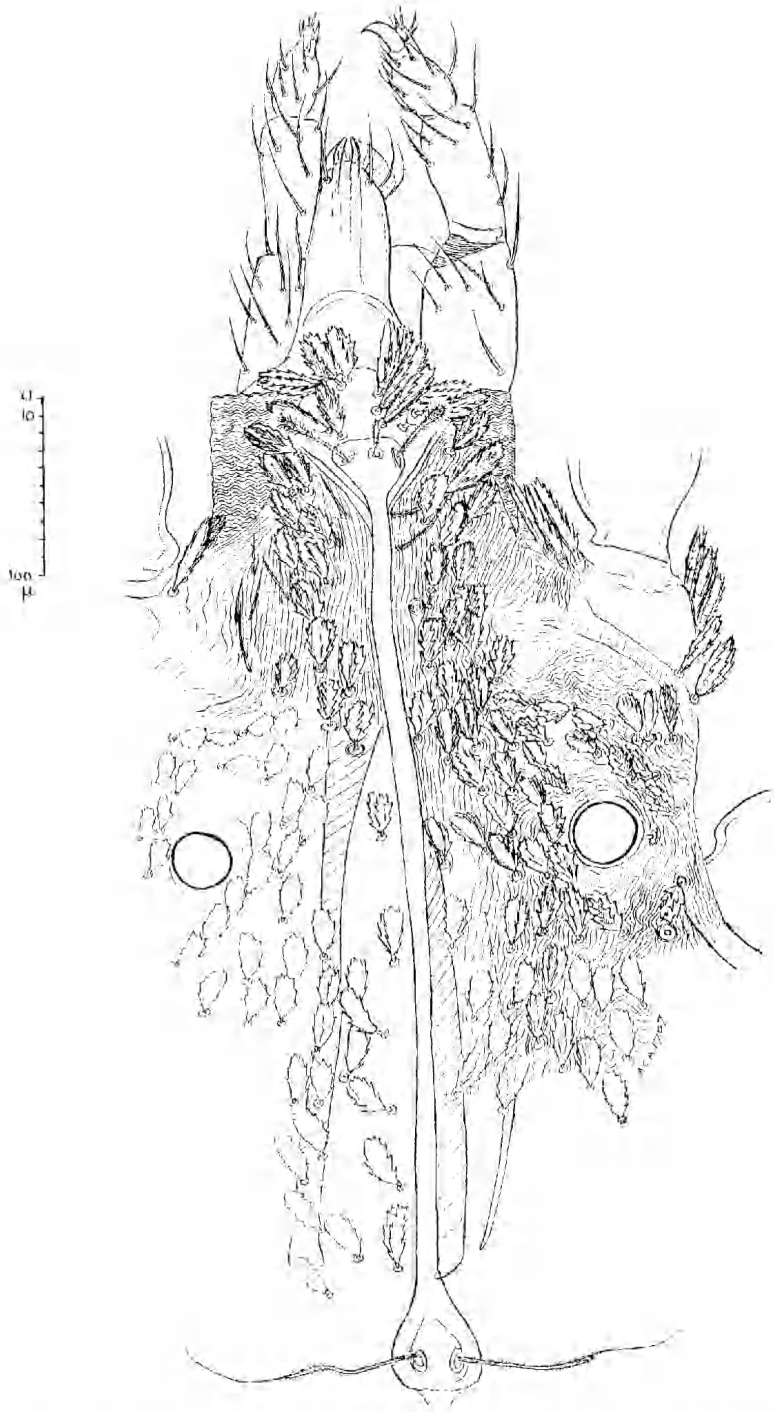

Fig. 36. *Trichosmaris dispar* subsp. *dentella*, subsp. nov. Adult female (holotype). Anterior part of dorsum of idiosoma and some adjacent and underlying structures. Note the teratological anterior sensillary area, with three sensillae.

Material Examined. The sole specimen referred to this subspecies is specimen ACA 1707, holotype, "On *Epidendrum pentotis*, San José de Guatemala [, Guatemala]: at San Francisco. April 12, 1946. S.F. 20756. Lot 46-4416"; name of collector not stated, in United States National Museum collection.

Remarks. 1. *T. dispar dentella* may be distinguished from *T. dispar dispar* by the former's possessing prominent denticulations on the dorsal idiosomal scobalae, both at the edges of the tectum setae and of the carinal flange. These are distinct characters in the material studied. Compare Fig. 35 B-D with Fig. 31 B-J.

2. The anterior sensillary area of the holotype of *T. dispar dentella* is teratological. Three anterior sensillae are present, as figured (Fig. 36), the middle sensilla being shorter than the other two, which are taken as representing the normal anterior sensillae. A similar teratological abnormality was recorded by the author in *Fessonia australiensis* Southcott (see Southcott, 1946, p. 176 and Fig. 4C).

3. See below for a further discussion on speciation and subspeciation in *Trichosmaris*, as well as of the nomenclatorial aspects.

Trichosmaris jacoti (Southcott, 1946) comb. nov.

Figs. 37 and 38

Smaris sericea Jacot, 1938, p. 123, non *Trombidium sericeum* Say, 1821, p. 70.
Hirstiosoma sericea Womersley and Southcott, 1941, pp. 63, 78.
Hirstiosoma jacoti Southcott, 1946, p. 177 (nom. nov.).

Redescription of adult, ♂ (from lectotype specimen ACA 1755, mounted in canada balsam, and remounted in same medium in October, 1961) (Figs. 37, 38).

"Color of body vermillion [sic], legs paler" (teste Jacot, 1938, p. 124) (the mounted specimen is now decolorized). Animal of normal smaridid shape, with a normal nasus. Idiosoma 1185μ long by 670μ wide where widest (the specimen is only very slightly compressed).

Crista as recorded for genus; anterior sensillary area carries the two sensillae and 10 scobalae, latter similar to other dorsal idiosomalae but stronger, longer, more parallel-sided, 24-34μ long. Anterior cristal sensilla a little clavate, ciliated throughout its length, ciliations a little longer distally. Posterior cristal sensillae ciliated, almost parallel-sided, then narrowing, terminating in a narrow thread which appears to be a broken flagellum, on left 3μ long, on right 7μ long; pars clavata (clavum) 45μ long. The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
40	45 clavum 7+flagellum 52+	16	19	370	18-27

Eyes one on each side, cornea 28μ across. Eye centres placed 25μ anterior to mid-point of ISD (OAS = 160μ). Eyes fairly close to lateral edge of idiosoma in dorsal view.

Dorsal idiosomal scobalae typically smaridid, similar to those of *Trichosmaris dispar*, sp. nov. (q. v.).

Ventral surface appears normal, but not seen clearly in specimen, which is now mounted back upmost.

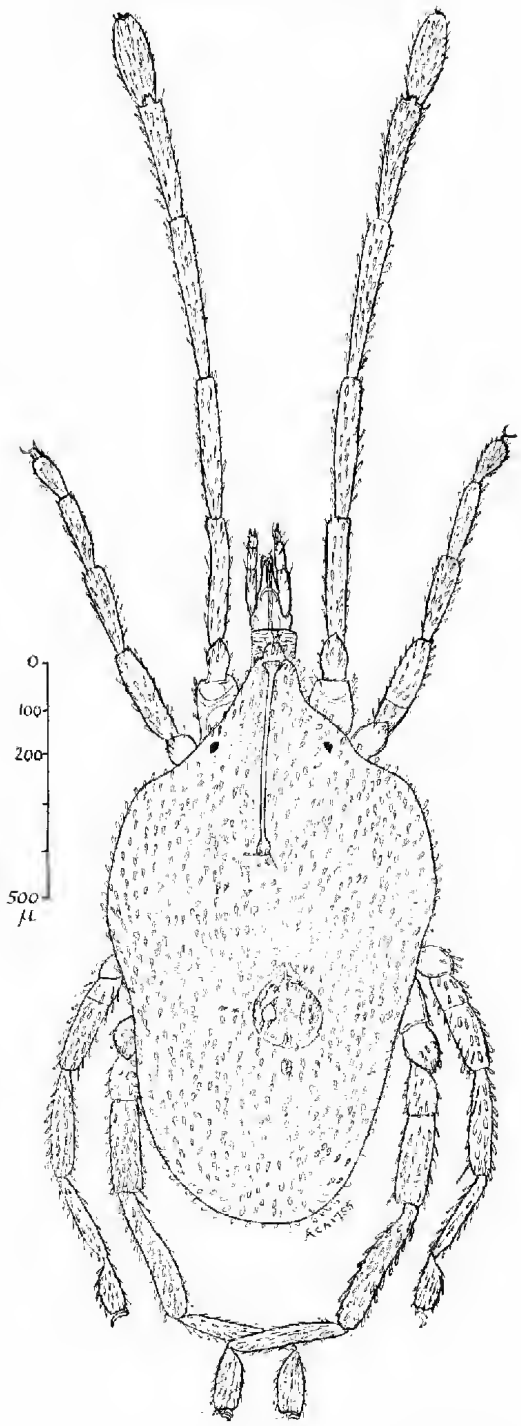

Fig. 37. *Trichosmaris jacoti* (Southcott). Adult, ?male (lectotype), dorsal view, somewhat in transparency, to show genitalia and anus.

Legs normal. Leg lengths (inclusive of trochanter–tips of tarsal claws): I 1430μ, II 790μ, III 895μ, IV 1160μ. Tarsus I 208μ long by 66μ across, tibia I 273μ long, genu I 341μ long, tarsus IV 133μ long by 44μ high, tibia IV 287μ long, genu IV 305μ long. For leg segment ratios see Table IV. Setae of legs appear normal for Smarididae.

Gnathosoma with normal armilla. Palpal scobalae slender, tapering, pointed, lightly (adnately) ciliated.

Localities (both specimens in Museum of Comparative Zoology, Harvard). Specimen ACA 1755, lectotype (here designated), adult, ♀?, 'From under bark of prone pines, north of Darien, G[eorgi]a, [United States of America], April, 1936, coll. by A. P. Jacot', slide labelled also '36 S6–1', 'Topotypes', '1 = *Smaris sericeum* Say 1821' (= ACA 1755), '5 = *Trombiculoides scabrum* Say 1821' (= ACB 639), and 'Figured Jacot 1937 Psyche', 'A. P. Jacot Det.' (all in (presumably) writing of Jacot, except for the additional numbers ACA 1755 and ACB 639 of the present author). (Note: Jacot (1938, p. 125) refers to this specimen as 'slide 36S8-1'. See further under Remarks.)

Specimen ACA 1754, paratype (here designated), adult, ?sex, slide labelled '*Smaris sericeum* Say 1821 = *Hirstiosoma jacoti* n. n. Southcott 1945. Remounted P.V.A. Aug., 1949 H.W.' (L. H. label), and "A. P. Jacot Coll. 3655 Topotype. From under bark of large prone oak S. of Savannah, G. April 1936, Coll. A. P. Jacot" (R. H. label), all in Womersley's writing, to which the present author has added 'ACA 1754'. The specimen is in a damaged condition in the polyvinyl alcohol mountant, and no attempt to remount it has been made (nor should it be remounted in the future, as it is *in* a polyvinyl medium). Reference to Jacot (1938, p. 125) shows that this specimen was on slide 36S3 of Jacot, which presumably Womersley misread (the original label of Jacot is no longer on the slide. Jacot (loc. cit.) refers to this specimen as "One specimen from under bark of a large prone oak, outskirts south of Savannah; slide 36S3").

Remarks. Specimen ACA 1755 was mounted in balsam on a single slide as above, along with 5 specimens of '*Trombiculoides scaber* (Say) 1821' (sic, in Jacot (1938, p. 123); the slide label uses *scabrum*), which Wharton and Fuller (1952, p. 50) synonymize with *Trombicula splendens* Ewing, 1913. The smaridid mite was mounted upside down, and the (true) right palp was figured, the figure of Jacot (Plate XIV, Fig. 5) matching it accurately in structure, position and setation. The other figures given by Jacot do not certainly identify the specimen(s) used in the illustration(s). In view of the note on the slide by Jacot that this specimen was figured, and the confirmation from the figure of the palp, the author designates specimen ACA 1755 as the lectotype of *Hirstiosoma jacoti* Southcott, 1946. In order to redescribe the species the specimens (ACA 1755 and ACB 639 A-E) were remounted on to individual slides by the author, in October, 1961, to (xylol) balsam and ACA 1755 was placed back uppmost. Unfortunately the specimen is apparently defective in one important particular, that being in the character of the posterior sensilla of the crista. It appears as if a flagellum had been present, and broken off fairly short on each side, but not evenly. Support for this viewpoint is given by an examination of specimen ACA 1754, also from Georgia, United States of America, where the flagellum is present on each side for the posterior sensillae. It is not, however, possible to be quite certain about the status of the lectotype in this particular, and the author believes that the best course to take to protect the stability of the genus *Trichosmaris*, gen. nov., is to base its definition upon a species and a specimen whose status is not likely to be called into dispute, even though it may be a species synonym of *jacoti*. Accordingly, *Trichosmaris* has been based upon *T. dispar*, sp. nov. See further in the following section.

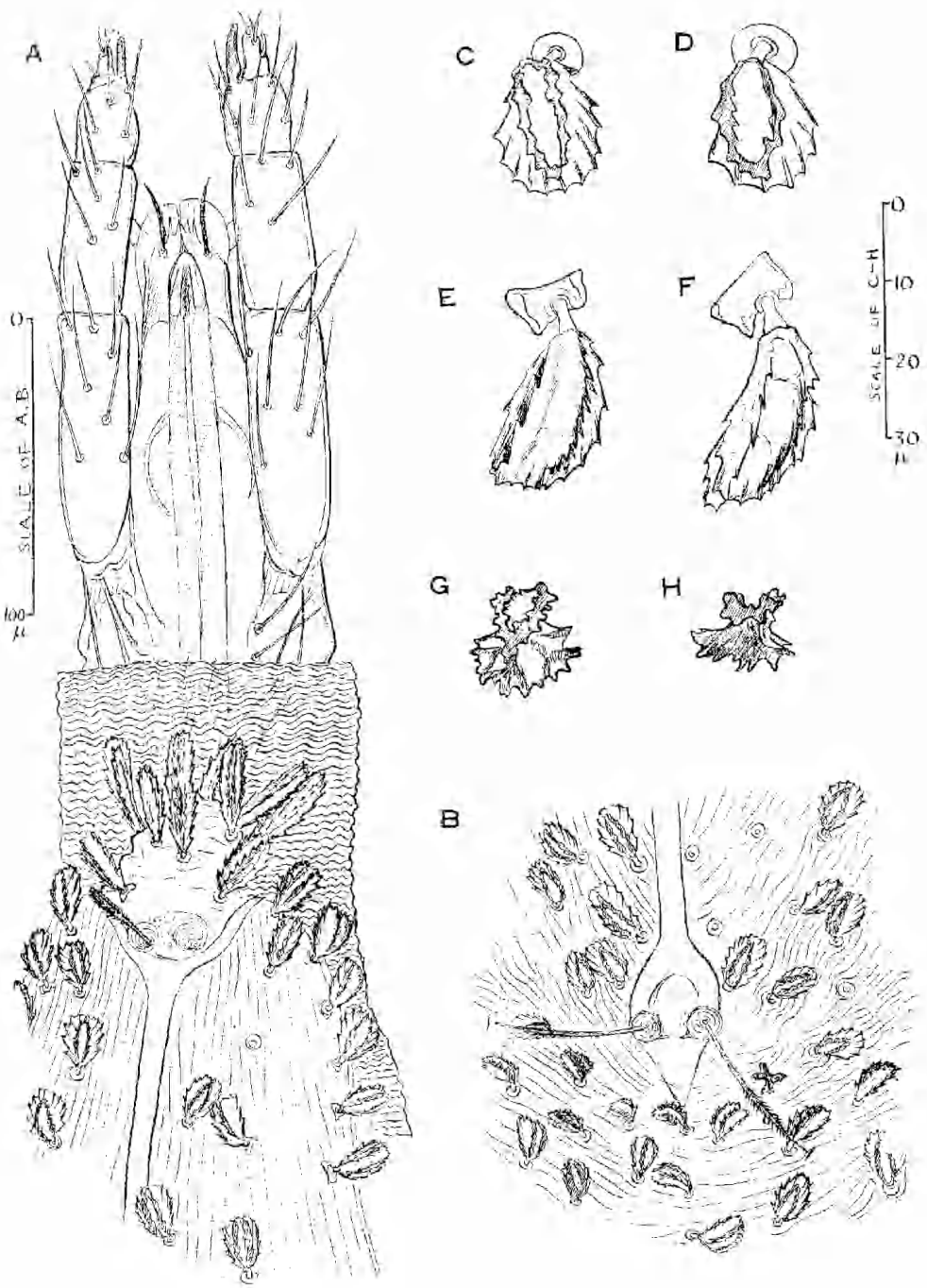

Fig. 38. *Trichosmaris jacoti* (Southcott). Adult, ?male (lectotype). A, gnathosoma and part of propodosoma, dorsal aspect, to scale on left. B, posterior sensillary area and surroundings, to same scale. C-H, dorsal idiosomal scobalae, to scale on right: C, D, tectal views; E, F, lateral views; G, H, end views.

REMARKS ON TAXONOMY AND NOMENCLATURE IN *TRICHOSMARIS*

Among the specimens referred in this paper to *Trichosmaris dispar* are some with variations in the size and character of the dorsal idiosomal scobalae, suggesting in fact that among them are incipient species (or subspecies) (see Dobzhansky, 1960). Thus some of the mites have shorter and more rounded setae, and others have a more denticulate character of the dorsal idiosomal setae than seen in the majority. Independent attempts have been made by the author, at intervals, to place the mites in subgroups, but these have in general not given consistent results. Only one specimen was considered distinct enough to warrant a subspecies, that being the holotype of *T. dispar dentella*.

The reasons for setting up *T. dispar* as a separate species from *T. jacoti* are given above; at present these are considered synonyms, but this will be discussed further below. It was finally concluded that further studies on subspeciation in *T. dispar* or *T. jacoti* might well be left until more extensive collections are available, and may be aided by adult-larva correlations.

Trichosmaris dispar is a large species of smaridid, and in North and Central America is surpassed in size only by *Hirstiosoma bolivari*, judging by the collections examined. Judging by these collections also, it is the commonest smaridid mite in North and Central America. It would therefore seem likely that it has been referred to in the previous literature of the Smarididae of this region (which is detailed at the beginning of the present article).

The author has referred earlier to *Smaris longilinealis* Ewing, 1909, described originally from a specimen collected in moss by L. M. Smith, at Marion, Illinois, United States of America. Of this specimen Ewing (1909, pp. 61-2) described the eyes as 1 + 1 ("A small single pair of eyes situated two-thirds the distance from the dorsal groove to the lateral margin"). He observed the posterior cristal sensillae, which he described as "two small simple hairs". He failed to observe the anterior cristal sensillae, remarking only upon a "whorl of bristles like those of the body" on the "anterior tubercle" (anterior sensillary area and nasus), and figured them diagrammatically.

In 1910 (p. 89) Ewing referred to a mite which he identified as the same species, from under bark, Urbana, Illinois (two specimens): "There is a double pair of eyes situated on the sides of the cephalothorax above the second pair of legs". If this is actually so, then this mite could not belong to the Hirstiosomatinae, and, in fact, by adding the character of the eyes to what is discernible of the crista from Ewing's Fig. 22 (Plate IV) of that paper, could belong only to *Fessonia* on the present knowledge of the North American Smarididae.

Thus in both 1909 and 1910 Ewing failed to recognize the anterior cristal sensillae. Many students of the Smarididae have similarly failed to recognize the correct status of the sensillae of the Smarididae (see Womersley and Southcott, 1941) for European and Australian members of the family. There is thus a distinct possibility that *longilinealis* Ewing, 1910, belongs to *Fessonia*. Perhaps however, too much should not be made of these differences in Ewing's accounts, as his work was at times of a superficial character. Unfortunately, the present author has not been able to locate any of these mites of Ewing in North America. According to Ewing (1909, p. 53) *Smaris longilinealis* Ewing, 1909, had its type specimen deposited in the Illinois State Laboratory of Natural History, whose collections have now been taken over into the Illinois Natural History Survey. According to Dr. L. J. Stannard, taxonomist, Section of Faunistic Survey and Insect Identification (personal communication to the author, 1961), the Ewing

TABLE I.

Metric data (length of segments and various proportions) of some Smaridiidae from North and Central America

	Specimen	Tarsus I	Tibia I	Genu I	Tarsus IV	Tibia IV	Genu IV	$\frac{\text{Tarsus I}}{\text{Tibia I}}$	$\frac{\text{Tibia I}}{\text{Genu I}}$	$\frac{\text{Tarsus IV}}{\text{Tibia IV}}$	$\frac{\text{Tibia IV}}{\text{Genu IV}}$
1.	*Trichosmaris dispar*, ♂, specimen ACA 1752, Ames, Iowa, 'Cotype' of *Smaris longilinealis* (see text)	199	279	362	133	287	314	·7133	·7707	·4634	·9140
2.	*Trichosmaris dispar*, ♀ Holotype, ACA 1724, Nebraska	210	295	382	142	320	332	·7119	·7723	·4438	·9639
3.	*Trichosmaris dispar*, nymph, ACA 1700, Mexico	133	194	245	85	203	203	·6856	·7918	·4187	1·000
4.	*Trichosmaris dispar dentella*, ♀, Holotype, ACA 1707, Guatemala	—	370	475	170	422	410	—	·7789	·4028	1·029
5.	*Trichosmaris jacoti*, ♂, lectotype, ACA 1755	208	273	341	133	287	305	·7619	·8005	·4634	·9410
6.	*Trichosmaris jacoti*, ? sex, adult, ACA 1754, Paratype	200	291	377	—	—	—	·6873	·7719	—	—
7.	*Smaris longilinealis* Ewing, 1909. Holotype, Marion, Illinois (from Ewing, 1909)	—	—	—	—	—	—	$\frac{2}{3}$	<1	$\frac{1}{2}$	slightly >1
8.	*Smaris longilinealis* Ewing, 1910, Urbana, Illinois (from Ewing, 1910)	177*	275*	—	—	—	—	$\frac{4}{7}$ (·6438*)	>1†	ca $\frac{1}{2}$	$\frac{2}{3}$†
9.	*Fessonia lappacea*, adult, male, Holotype, ACA 1714	146	194	178	106	206	188	·7526	1·090†	·5146	1·096
10.	*Fessonia lappacea*, nymph, ACA 1663	105	163	150	75	115	122	·6442	1·087†	·6522	·9426

*Estimated from Ewing's Fig. 23 of Plate IV (1910).

†Values considered discrepant from others within bigger in same column.

mite types are not in the collections of the Illinois Natural History Survey, Urbana, Illinois, having been taken away by Ewing when he left the Survey.

A specimen identified by Ewing as *Smaris longilinealis* and labelled "Cotype" has been made available to the author and is referred to above as specimen ACA 1752, under *Trichosmaris dispar*. Since this mite came from Ames, Iowa, and not Illinois, it is clearly not the holotype, and its conspecificity with *Smaris longilinealis* Ewing, 1909, is uncertain, particularly in view of *longilinealis* Ewing, 1910 (upon which further comment is made below). At most, specimen ACA 1752 can be regarded as a homeotype (see Schenk and McMasters, 1956, p. 7) of *longilinealis* Ewing, 1909, if later work shows these two specimens are conspecific.

Ewing (1909, p. 62) stated of *longilinealis* Ewing, 1909, tibia I is 'not as long' as genu I, and tibia IV is 'slightly longer' than genu IV. Ewing (1910, p. 89) stated of *longilinealis* Ewing, 1910, that tibia I is 'longer than' genu I, and tibia IV is 'two-thirds as long as' genu IV. These differences may be of significance, and may help to identify these species in the absence of the actual specimens. Table V gives certain metric data of specimens of *Trichosmaris dispar*, sp. nov., *T. jacoti* (Southcott, 1946), and compares them with the available similar data for *Smaris longilinealis* Ewing, 1909, and *Smaris longilinealis* Ewing, 1910. Since the eye character and other features described for *Smaris longilinealis* Ewing, 1910, suggest *Fessonia*, similar data are included of *Fessonia lappacea*, sp. nov., this being the only species of *Fessonia* which has so far been recorded for the United States of America (California and South Carolina).

Examination of Table I suggests that the proportions of the leg segments selected may be useful for systematic purposes among these mites. The segments were selected primarily because Ewing refers to them, and it was hoped that their study might help to clarify the status of *longilinealis* Ewing, 1909, and *longilinealis* Ewing, 1910. The figures given of the proportions do not conflict with the hypothesis that *jacoti*, *dispar* and *longilinealis* Ewing, 1909, are conspecific. The proportion Tibia I/Genu I in *longilinealis* Ewing, 1910, is in agreement with *Fessonia lappacea*, but is markedly discrepant from *jacoti*, *dispar* and *longilinealis* Ewing, 1909. However, in the column of proportions for Tibia IV/Genu IV the only value not in the range ·91-1·10 is that for *longilinealis* Ewing, 1910. If the estimate of Ewing for that proportion, as 2/3, is correct, then it suggests that *longilinealis* Ewing, 1910, is not conspecific with any other mite listed in Table I.

Genus Clavismaris, gen. nov.

Type species (original designation): *Clavismaris conifera*, sp. nov.

Definition (Adults and Nymphs).

Smaridid mites with one eye on each side. Posterior cristal sensillae clavate, ciliated, without flagellum. Tarsus IV of male normal, not enlarged.

Larva not known.

Remarks. Among the Hirstiosomatinae studied from North and Central America was a small number in which the anterior and posterior cristal sensillae were clavate, and the posterior sensillae were without a flagellum. Owing to the general similarity between the dorsal idiosomal scobalae of a number of the Smarididae of this region, as well as other factors, it was at first thought that these specimens in which the flagellum was absent represented specimens of *Trichosmaris* in which the flagellum had broken off (see e.g. the account of

the lectotype of *Trichosmaris jacoti*). More careful study showed, however, that this view was untenable, and it was possible to distinguish a small number of specimens which were not conspecific with the *Trichosmaris* specimens studied, and in which at least one posterior cristal sensilla appeared to be intact, and resembled that of the Australian genus *Sphaerotarsus*. Among these specimens both males and females were present. The tarsus IV of the males was not enlarged. It was finally concluded that this group of Smarididae constituted a separate genus. At the present time the female cannot be distinguished from *Sphaerotarsus*, but since there is no evidence that *Sphaerotarsus* occurs outside the Australian region, and none that *Clavismaris* occurs outside North and Central America, females are identifiable as long as their region of origin is known. The author recognizes two species, separable as in the following key.

Key for the Separation of the Species of *Clavismaris*

Dorsal palpal scobalae adnately ciliated. Tectum setae of dorsal idiosomal setae solid, convex, with, apart from the tectal borders, 6-8 spicules, projecting, arranged in two or three columns, but the pattern of columns not strongly defined. ISD 381μ long. Ratio Tibia IV/Genu IV 0·85
C. conifera, sp. nov.

Dorsal palpal scobalae somewhat expanded, with outstanding ciliations. Tectum setae of dorsal idiosomal scobalae with four projecting columns of spicules, two being along the tectal borders and two along the tectum setae about midway between the neomedian line and the tectal borders; these two non-bordering (paramedian) columns comprising 15-20 spicules. ISD 267μ long. Ratio Tibia IV/Genu IV 1·00-1·02 *C. cybaea*, sp. nov.

Clavismaris conifera sp. nov.

Figs. 39 and 40

Description of Adult Female (from Holotype ACA 1690).

Colour in life not recorded, in slide mount brownish with moderately pigmented setae. Animal of typical smaridid shape, fairly robust. Nasus normal. Idiosoma 1070μ long by 555μ wide where widest.

Crista linear, normal, with two sensillary areas. Anterior sensillary area has two clavate sensillae, ciliated, and carries also on the nasus 17 scobalae 20-26μ long. Posterior sensillary area of crista with two clavate ciliated sensillae, as figured, the ciliations longer over the expanded part. The crista extends about 25-30μ behind centres of PSens (a little obscured in the preparation).

The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
22	43	12	13	381	16-24

Eyes one on each side, approximately circular, cornea about 20μ across. Line between eye centres 7·5μ anterior to mid-point of ISD (OAS = 183μ, OPS = 198μ).

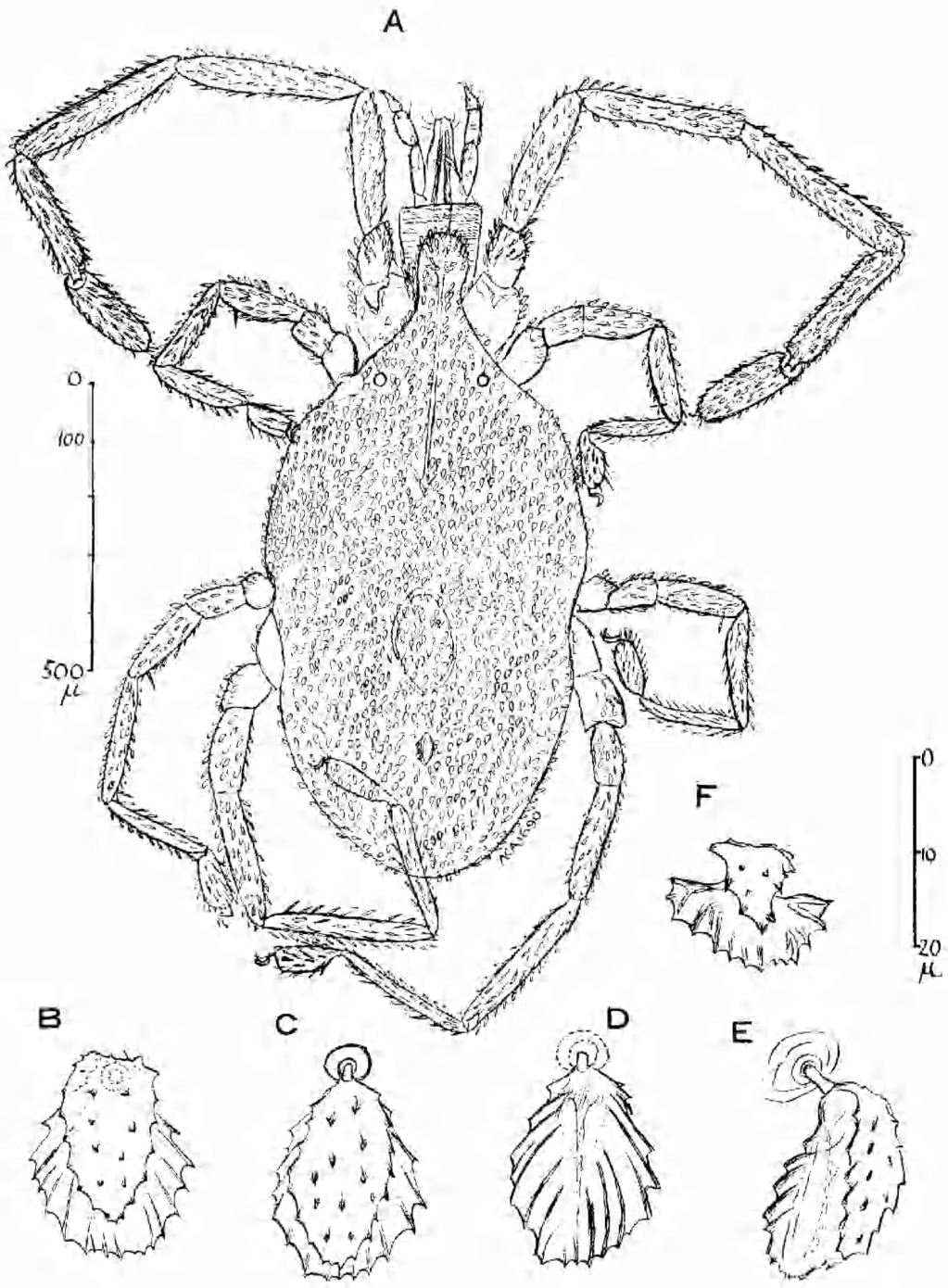

Fig. 39. *Clavismaris conifera*, sp. nov. Adult female (holotype). A, entire dorsal view of slide mount (slightly in transparency), to scale on left. B-F, dorsal idiosomal scobalae, various aspects, to scale on right: B, C, tectal views; D, carinal view; E, lateral view; F, end view.

Dorsal idiosomal scobalae uniform, typically smaridid, moderately pigmented. The tectum setae is solid, convex, with the tectal borders cut into coarse serrate teeth, each with a proximal stiffening rib. In addition to these the tectum setae carries 6-8 spicules which may form two or three more or less regular columns, or they may be irregular. Carinal flange expanded into coarse serrations with stiffening chitinous ribs, outline of carinal flange from above almost circular, with serrations.

Ventral surface normal. Central ventral idiosomalae bushy, with long ciliations. External genitalia 210μ long by 110μ wide (lips open). (The specimen is dorsum uppermost and details of the ventral surface are not clear. However, the internal genitalia are not chitinized, hence the animal is a female.) Anus 65μ long by ca 40μ across.

Legs normal. Leg lengths (inclusive of trochanter, to tips of tarsal claws): I 1450μ, II 770μ, III 895μ, IV 1210μ. Tarsus I 200μ long by 62μ across, tibia I 265μ long, genu I 337μ long, tarsus IV 112μ long by 43μ high, tibia IV 270μ long, genu IV 318μ long. Hence the following leg segmental ratios are derived:

$\frac{\text{tarsus I}}{\text{tibia I}}$	$\frac{\text{tibia I}}{\text{genu I}}$	$\frac{\text{tarsus IV}}{\text{tibia IV}}$	$\frac{\text{tibia IV}}{\text{genu IV}}$
·7547	·7864	·4148	·8491

Setae of legs normal for Smarididae. Distal scobalae of leg segments (except tarsi) tend to be clavate or foliose. Dorsal tarsal setae with long strong ciliations, setae tending to be lanceolate, foliose, with 4-5 columns of linked ciliations. Terminally on tarsus II, III and IV are some modified scobalae, expanded distally ('spoon-like setae').

Gnathosoma normal, with normal armilla. Dorsal palpal scobalae pointed, lightly ciliated. Hypostomal setae tapering, pointed, adnately ciliated.

Locality. Known only from the holotype female, specimen ACA 1690, on orchid plants, Chilpancingo [de los Bravos], G[uerre]ro, Mexico: at Laredo, United States of America, February 4, 1947, Jackson, colr. Lot 47-3559. In United States National Museum collection.

Remarks. See under *Clavismaris*, and under the following species.

Clavismaris cybaea sp. nov.

Figs. 41-43

Description of Adult Male (from Holotype ACA 1711).

Colour in life not recorded. Animal of normal smaridid shape, with a normal nasus. Idiosoma 1160μ long by 565μ wide (the holotype is somewhat compressed in the slide mount, but these figures are an estimate of the uncompressed state based on the fixed idiosomal contents—see Fig. 41).

Crista linear, normal. Anterior sensillary area of crista with two clavate ciliated sensillae, and carries also on nasus 8 strongly ciliated scobalae, about 3-4 times as long as wide, 30-34μ long. Posterior sensillary area with two ciliated

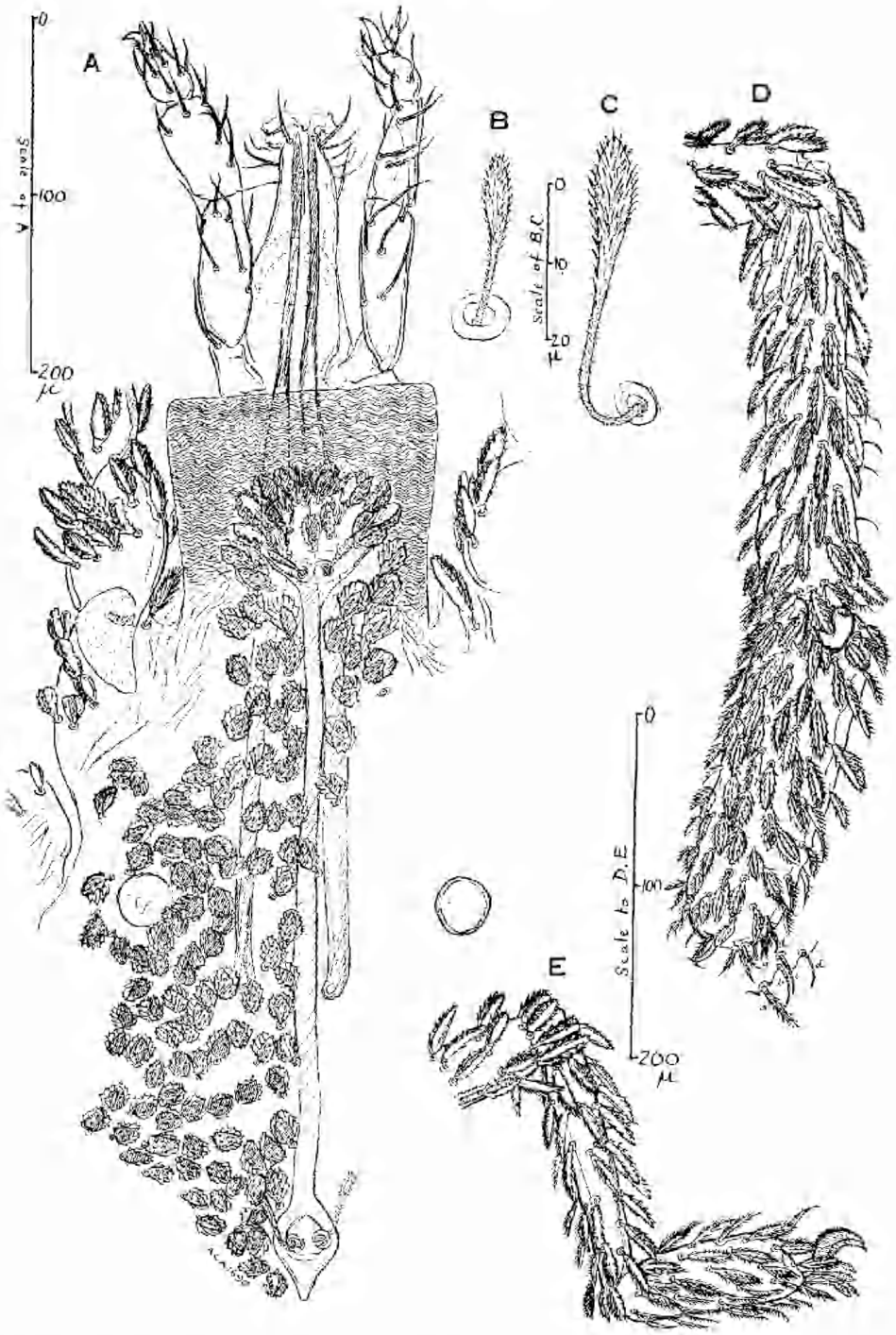

Fig. 40. *Clavismaris conifera*, sp. nov. Adult female (holotype). A, propodosoma and gnathosoma, dorsal aspect. B, anterior cristal sensilla. C, posterior cristal sensilla. D, distal part of right leg I, posterodorsal aspect. E, distal part of right leg II, posterior aspect. (All figures to adjacent scales, as shown.)

clavate sensillae, the expanded part somewhat fusiform (see Fig. 42A). Crista extends 28μ behind centres of PSens. The standard data are:

ASens	PSens	SBa	SBp	ISD	DS
28	47	14	13	267	12-24

Eyes one on each side, cornea 18μ across, but with the surrounding part included the eye is 26μ across (see Fig. 42A). Line joining centres of eyes is 31μ behind mid-point of ISD (OAS = 164μ, OPS = 103μ).

Dorsal idiosomal scobalae lightly chitinized, variable in character, but typically smaridid. Tectum setae forms an oblong or oval band with four projecting columns of spicules, two being along the tectal borders, and two being placed in a paramedian situation along the tectum setae, these two comprising together about 15-20 spicules. Distally the paramedian columns may become somewhat irregular. The appearance of the dorsal scobala is therefore strongly prismatic in some views, and in end view the tectum has an excavated appearance between the columns. The carinal flange is moderately expanded, with strong spicules or ciliations; from above it is roughly triangular or obovate.

Ventral surface normal, the central ventralae bushy with long ciliations. Internal genitalia clearly of male type. External genitalia 200μ long. Anus oval, 63μ long by 33μ across with the lips open.

Legs normal. Leg lengths (inclusive of trochanter–tips of tarsal claws): I 1370μ, II 890μ, III 1010μ, IV 1430μ. Tarsus I 188μ long by 66μ across, tibia I 270μ long, genu I 305μ long, tarsus IV 115μ long by 41μ high, tibia IV 350μ long, genu IV 344μ long. Hence the following ratios are derived.

$\frac{\text{tarsus I}}{\text{tibia I}}$	$\frac{\text{tibia I}}{\text{genu I}}$	$\frac{\text{tarsus IV}}{\text{tibia IV}}$	$\frac{\text{tibia IV}}{\text{genu IV}}$
·6963	·8852	·3286	1·017

Tarsus IV not enlarged. Setae of legs typically smaridid, scobalae strong, well ciliated, setae on distal parts of segments (except tarsi) tending to be clavate or foliose.

Gnathosoma normal, with normal armilla. Palpi with dorsal scobalae somewhat expanded, well ciliated with outstanding ciliations, pigmented. Setae of mouthcone tapering, pointed, adnately ciliated.

Locality. Holotype male specimen ACA 1711, in banana debris, Costa-Rica, at New York, August 5, 1935, Goolsby, New York No. 46057. In United States National Museum collection.

Paratype male specimen ACA 1712, on onion leaf, France; at New York, March 19, 1936, McMaster colr., N.Y. 55936, Lot 36-6392, United States National Museum collection (see remarks below).

Adult female specimen ACA 1713, Camp Bullis, Texas, United States of America, October 19, 1943, J. M. Brennan, Lot 43-14596 (see remarks below); U.S.N.M. collection.

Remarks. (1) The holotype male has only one posterior cristal sensilla, the clavate part of which is somewhat fusiform. At first examination it was thought

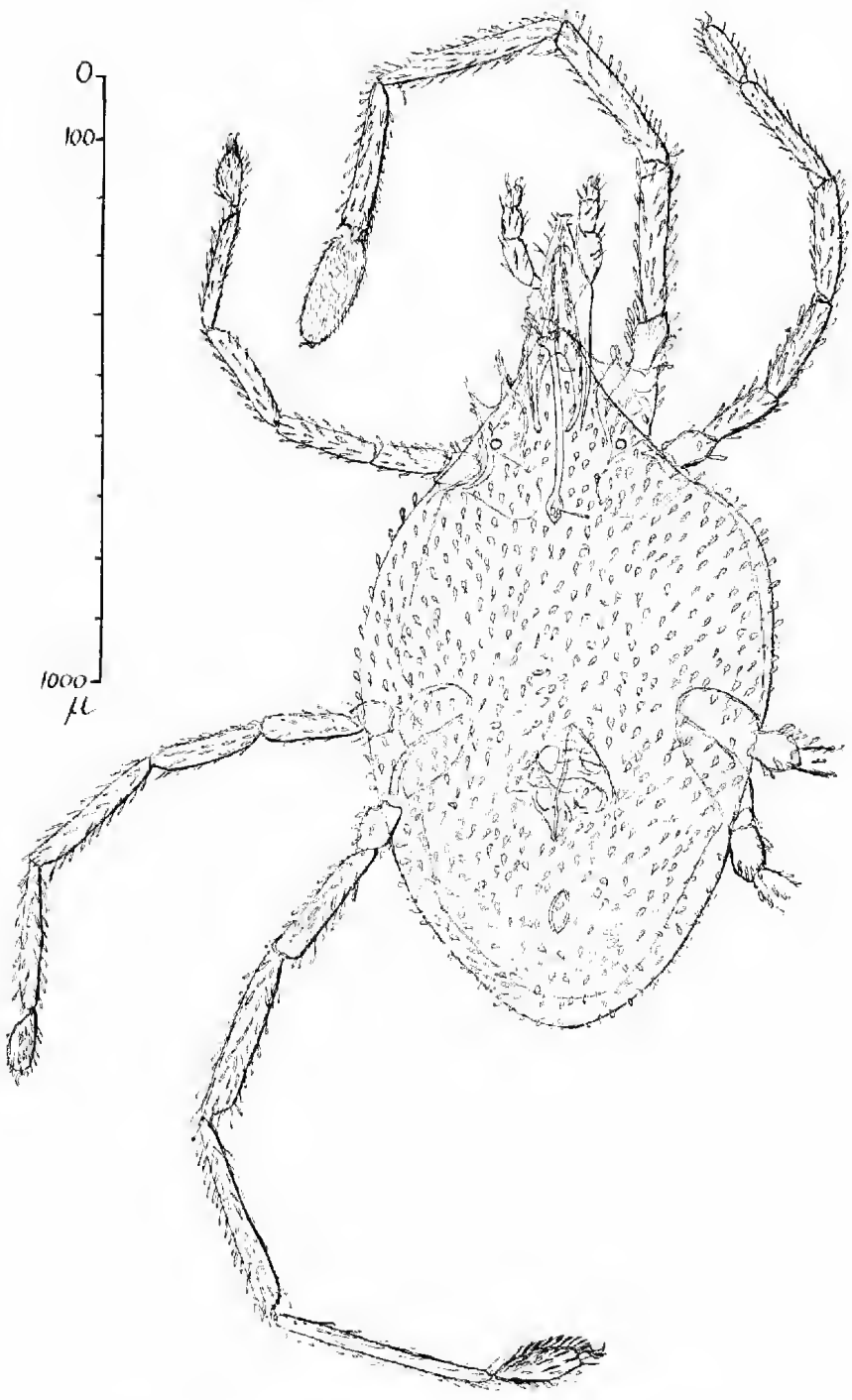

Fig. 41. *Clavismaris cylaea*, sp. nov. Adult male (holotype), dorsal aspect, partly in transparency.

that this specimen was one of *Trichosmaris dispar* in which the flagellum had broken off the pars clavata (clavum) of the PSens. The dorsal idiosomal scobalae resemble those of *T. dispar* to some extent. More careful examination showed this mite represents a separate species. One distinct feature which separates it off from all the other North American Hirstiosomatinae is the tendency to expansion of the dorsal palpal scobalae. In this feature the specimen possibly resembles *Smaris* sp. Jacot (1938, p. 125). Jacot referred to but did not figure this feature. He did, however, give a figure of the dorsal idiosomal scobala of his species, and these appear to resemble those of *C. cybaea*. Further comparison is not possible, as Jacot gave no further detail of his specimen, and this has not become available for restudy.

As indicated above, but for the character of the male tarsus IV, this mite would answer to the Australian genus *Sphaerotarsus*; however, see the earlier comment.

(2) Specimen ACA 1712 has the following standard data:

ASens	PSens	SBa	SBp	ISD	DS
26	36	13	14	267	15-20

The following are some further data:

tarsus I	tibia I	genu I	tarsus IV	tibia IV	genu IV
179	254	291	106	328	328

$\frac{\text{tarsus I}}{\text{tibia I}}$	$\frac{\text{tibia I}}{\text{genu I}}$	$\frac{\text{tarsus IV}}{\text{tibia IV}}$	$\frac{\text{tibia IV}}{\text{genu IV}}$
·7047	·8729	·3232	1·000

Although the dorsal setae are rather smaller than in the holotype, and in most instances there appears to be a distinct gutter down the neomedian plane of the tectum setae, it appears justifiable to identify this male specimen as *C. cybaea*.

The two PSens differ from each other. One is distinctly clavate, while the other is only a little swollen distally. In neither case is there any evidence of a flagellum, and it may therefore be accepted that there was none. It may therefore be accepted with confidence that this specimen belongs to the genus *Clavismaris*.

The slide label indicates the belief of the collector that the specimen which was collected at New York had originated in France. Since, however, up to the present no European smaridid mite has been described with a clavate PSens, and since it may justifiably be identified as *Clavismaris* which, so far, is known from only North and Central America, the possibility that this mite originated in North America should be examined. Assuming that the ship concerned belonged to the north Atlantic run one possibility is that the mite was taken aboard in North America in vegetables, and that further vegetables were added in France for the return trip. The nymphal and adult stages in the Smarididae are quite long (see Womersley and Southcott, 1941; Southcott, 1960, 1961*a*), and there is the further possibility of a pupal stage having occurred between a

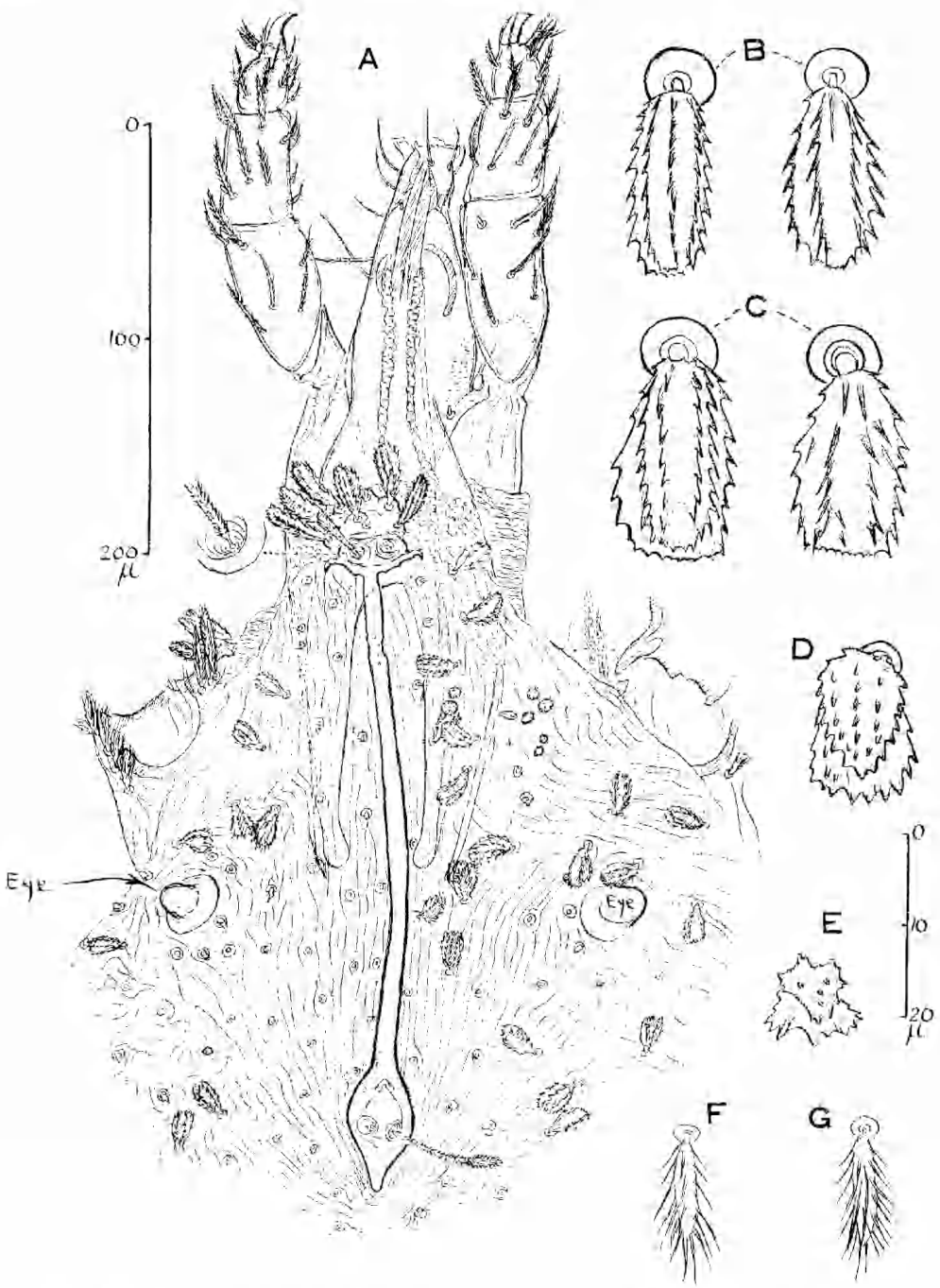

Fig. 42. *Clavismaris cybaea,* sp. nov. Adult male (holotype). A, propodosoma and gnathosoma, to scale on left. Some fungal spores are shown on the right of the anterior half of the crista. Such spores are not uncommonly attached to the surface of erythraeoid mites. B-E, dorsal idiosomal scobalae, various aspects: B, a seta from above and below (left and right side respectively); C, another seta, similarly; D, oblique end view; E, end view. F, G, ventral idiosomal setae. (B-G to scale on right.)

nymphal and adult instar. Even if sterilization of vegetable racks were attempted by, e.g. steam or other means, it would not necessarily be completely successful. The author therefore considers that at present this mite is on the evidence available most likely to have originated in North or Central America.

(3) The adult female specimen ACA 1713 contains in the mounted preparation four eggskins; one of these is not crumpled and measures about 230μ long by 175μ across, with its skin smooth, brown (but burst at one end). The data of the mite are as follow:

ASens	PSens	SBa	SBp	ISD	DS
21	38	13	12	351	15-20

tarsus I	tibia I	genu I	tarsus IV	tibia IV	genu IV
175	228	255	125	257	275

$\frac{\text{tarsus I}}{\text{tibia I}}$	$\frac{\text{tibia I}}{\text{genu I}}$	$\frac{\text{tarsus IV}}{\text{tibia IV}}$	$\frac{\text{tibia IV}}{\text{genu IV}}$
·7675	·8941	·4864	·9345

The PSens are ciliated, very little expanded (tapering distally), and without flagellum.

Although the specimen in general answers to *C. cybaea*, in some characters it is intermediate between that species and *C. conifera*. It will be noted that *C. conifera* is erected on a female specimen, while *C. cybaea* is erected on a male, but on the characters of other smaridid mites it is thought unlikely this difference in the sexes of the two specimens would be of much significance in external morphology. In view of these considerations this specimen is placed somewhat dubiously in *C. cybaea*, and is not designated an allotype. The selection and description of an allotype should be left until further specimens are available, and possibly more is known of the genus. The discovery of the larva of this genus, and its comparison with the larval *Sphaerotarsus*, would be of considerable interest.

IV. DOUBTFUL OR EXCLUDED SPECIES

Smaris longilinealis Ewing, 1909

Smaris longilinealis Ewing, 1909, p. 61.
Smaris longilinealis Jacot, 1938, p. 125 (in part).
Smaris longilinealis Southcott, 1946, p. 178.
Hirstiosoma longilinealis Baker and Wharton, 1952, p. 243.
nom *Smaris longilinealis* Ewing, 1910, p. 88.

Remarks. The status of this species was discussed above, under the remarks on the taxonomy and nomenclature in *Trichosmaris*, gen. nov. This species probably belongs to *Trichosmaris*, and is possibly a synonym of *T. dispar*, sp. nov., and *T. jacoti* (Southcott, 1946), but this question must be left for the future, depending firstly on the type of *longilinealis* Ewing, 1909, becoming available for restudy.

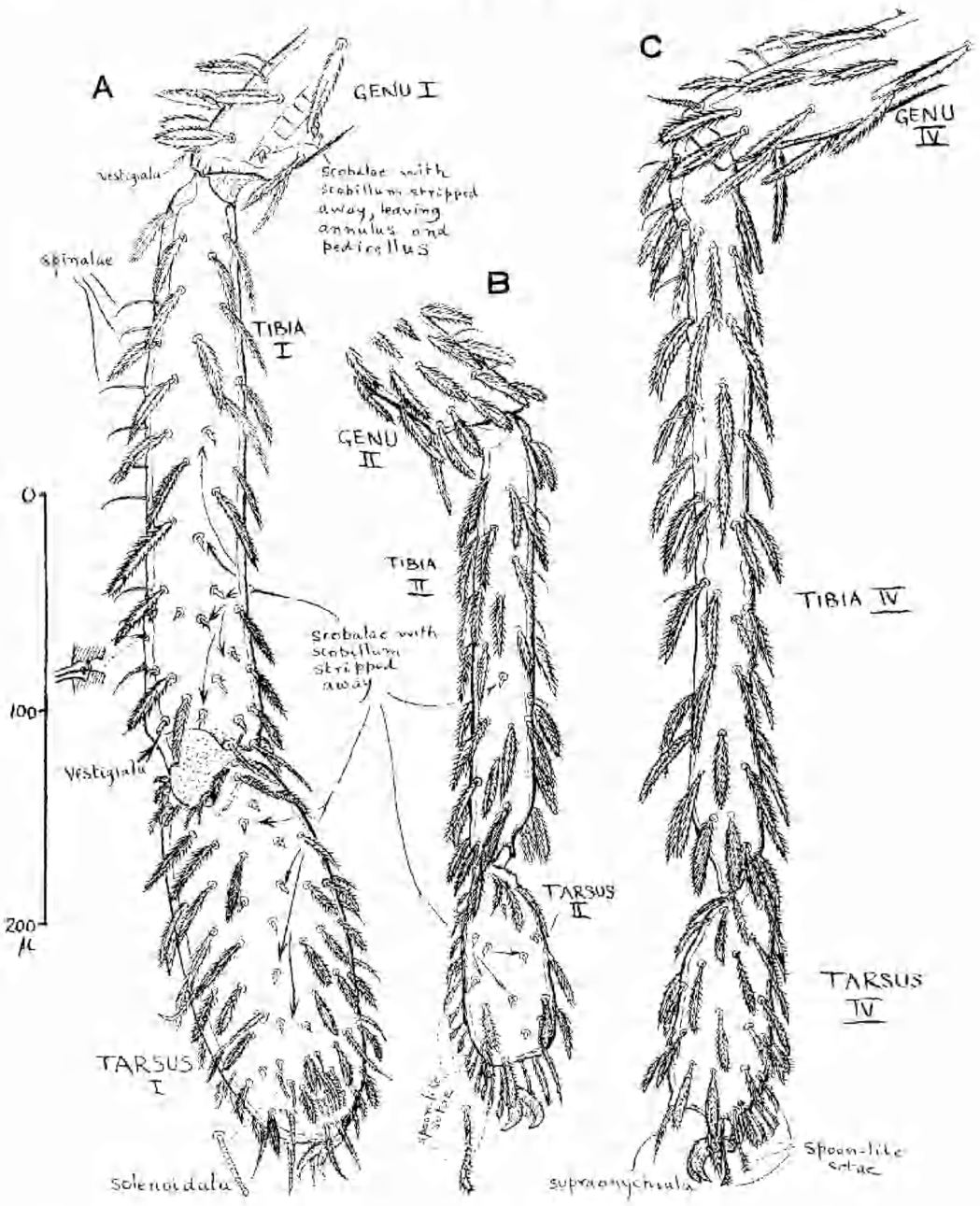

Fig. 13. *Clavismaris cybaea*, sp. nov. Adult male (holotype). A, posterodorsal aspect of left leg I, distally. B, anterior aspect of left leg II, distally. C, anterior aspect of right leg IV, distally. (All to scale shown.) In A, B the short peg-like structures are the pedicles of the scobalae from which the scobillum has in each case been stripped away, from expansion of the polyvinyl alcohol mounting medium on attempted remounting (through water to methyl cellulose medium). Other setae—solenoidalae, spinalae and intermediate type scobalae have not suffered in the process. In C, some spoon-like setae are seen distally on the tarsus.

Smaris longilinealis Ewing, 1910

Smaris longilinealis Ewing, 1910, p. 88.

Smaris longilinealis Jacot, 1938, p. 125 (ex Ewing, 1910, p. 88 (in part)).

non *Smaris longilinealis* Ewing, 1909, p. 61.

Remarks. The status of this species was discussed earlier in this paper, when it was compared with *longilinealis* Ewing, 1909 (q.v., supra, also the remarks on taxonomy and nomenclature in *Trichosmaris*, earlier). This species possibly belongs to *Fessonia*, and it is possible it is a synonym of a species described in this paper, but some features are doubtful. Its generic and specific placing can be determined only by a restudy of the material upon which Ewing's (1910) account was based, if it can be located.

Smaris mamillatus (Say)

Erythraeus mamillatus Say, 1821, p. 70 (teste Jacot, 1938, p. 123; Oudemans, 1937, K.H.O.A. IIIC, p. 952).

Smaris mamillatus Oudemans, 1937, p. 952.

Erythraeus mamillatus Jacot, 1938, p. 125 (allotted doubtfully to *Labidostoma* (sic)) (for *Labidostomma* Kramer, 1879, family Labidostommatidae).

Smaris mamillatus Southcott, 1946, p. 175.

Labidostomma mamillatus Banks, 1947, p. 129.

Labidostomma [*mamillatum*] Southcott, 1961*a*, p. 574.

non *Smaris mamillatus* Baker and Wharton, 1952, Fig. 179, p. 242.

(? = *Smaris lanceolata*, sp. nov., of the present paper.)

Remarks. The position of Say's species was discussed by the author earlier (1961*a*, pp. 573-4), where it was considered that in the interests of stability of nomenclature Banks (1947) should be accepted as the first reviser of Say's species (which should therefore be named *Labidostomma mamillatum*, nom. emend.).

The possible synonymy of the species figured by Baker and Wharton (1952, Fig. 179, p. 242) was discussed earlier; see the remarks under *Smaris lanceolata*, sp. nov.

Smaris sp. (unnamed) Jacot

Smaris sp. Jacot, 1938, p. 125.

Hirstiosoma sp. Womersley and Southcott, 1941, pp. 63, 78.

Remarks. Jacot (1938, p. 125) referred briefly to this form "from under bark at base of hickory trees, Cosceb Headland, Conn.", and gave some figures of the dorsal idiosomal scobalae. The specimen or specimens were discussed above, under the remarks for *Clavismaris cybaea*, sp. nov. The species is certainly a member of the Smarididae, but is not placeable further with certainty. Jacot's material will need to be restudied before it can be decided whether this species belongs to *Clavismaris* or some other genus.

A NOTE ON MOUNTING MEDIA SUITABLE FOR SMARIDIDAE

The author has had over 25 years' experience in the use of various mounting media for the microscopic examination of smaridid (and other mites). It has been found that in general gum chloral media are the most satisfactory for permanent use. In these further clearing agents such as acetic acid or lactic acid may be incorporated, or the mite may be mounted permanently in the medium after an initial examination in temporary media, such as lactic acid, glycerol-lactic or lactophenol. Some of the older mounts in balsam are still good after over 50 years from the older students of the Acarina, and such mites can if necessary be remounted through xylol back to (xylol)-balsam. The lectotype of *Trichosmaris jacoti* has been thus remounted, and is in good condition. Such balsam mounts have the disadvantage that the body contents are not digested, and thus there is insufficient flattening of the specimen for the use of the oil immersion lens on critical parts of the animal. Against this may be set the minor advantage that the natural shape of the animal is fairly well preserved. Attempts to transfer from balsam to other (water soluble) media are not always successful, and the specimen remains with a precipitate of resin which obscures details.

Polyvinyl acid media give good clearing of mite specimens, and often allow better positioning of the limbs of the animal than e.g. gum chloral media. After the medium is completely set, its refractive index rises and fine details may not be visible. Attempts to remount the specimen at that stage may be disastrous —the medium expands to a jelly, but does not liquify. With the differential expansion the animal's setae are torn off freely in many cases, and the same may occur with the limbs. An appearance of an endocast of the limb segment or seta is often left in the medium. With differential changes in the refractive index of the medium, which may last for months, possibly longer, many details of the animal may be obscured, in addition to the damage. The author attempted to remount a large batch of such slides on one occasion, damaging a number, and regrettably found himself in a position of not being able to give detail of e.g. palp structure, sensillae, etc., which should be given if available. From this experience it has been decided to abandon completely the use of polyvinyl alcohol media in acarology.

VI. ACKNOWLEDGMENTS

The author is indebted to Dr. Edward W. Baker, formerly attached to the United States National Museum, for suggesting this revision, and to him and the Museum for arranging the loan of material; to the Director, South Australian Museum, and Mr. H. Womersley, Honorary Acarologist, for access to the Acarina collection of that institution; to Mr. W. F. Rapp, Jr., Entomologist, Department of Health, State of Nebraska, for material; to the Museum of Comparative Zoology, Harvard, for the loan of a slide of Jacot's material.

VII. REFERENCES

ATYEO, W. T., and CROSSLEY, D. A., 1961. The Labidostomidae of New Zealand (Acarina). Rec. Dominion Mus., 4 (4), pp. 29-48.

BAKER, E. W., and WHARTON, G. W., 1952. An Introduction to Acarology. (Macmillan: New York.)

BERLESE, A., 1883. *Rhyncholophus squamatus* (Hérm.) Berl. A.M.S., 5, p. 4.*

*See Southcott, 1961*a*, p. 608, for further remarks on the Berlesian references.

BERLESE, A., 1884. *Smaridia papillosa* (Hérm.) Dug. A.M.S., **16**, p. 3.

BERLESE, A., 1894. *Smaridia* Dugès, 1834. A.M.S., **71**, p. 4.

DOBZHANSKY, T., 1960. Second Sir William Macleay Lecture. Bridging the Gap Between Race and Species. Proc. Linn. Soc. N.S.W., **85** (3), pp. 322-7.

EWING, H. E., 1909. New North American Acarina. Trans. Acad. Sci. St. Louis, **18**, pp. 53-77.

EWING, H. E., 1910. A Systematic and Biological Study of the Acarina of Illinois. The University Studies, Univ. Illinois, Vol. 3, Pt. 6, pp. 1-120 (published as part of Univ. Ill. Bull. **7** (14), pp. 350-472 and plates I-VIII teste Jacot, 1938, p. 130.
(The Int. Cat. Sci. Lit., 1911, Entry 46, refers to this as Urbana-Champaign Stud. Univ. Ill. In this work both systems of numbering are present on the pages. Page 120 = 472. Page 1 does not seem to exist.)

EWING, H. E., 1913. New Acarina. Bull. Amer. Mus. Nat. Hist., **32**, pp. 93-121, teste Wharton and Fuller, 1952, p. 157.

GRANDJEAN, F., 1935. Les poils et les organes sensitifs portés par les pattes et le palpe chez les Oribates. Premiere partie. Bull. Soc. Zool. Fr., **60**, pp. 6-39.

GRANDJEAN, F., 1947. Études sur les Smarisidae et quelques autres Érythroïdes (Acariens). Arch. Zool. Exp. Gén., **85** (1), pp. 1-126.

JACOT, A. P., 1938. Thomas Say's Free-living Mites Rediscovered. Psyche, **45** (2-3), pp. 121-32.

KRAMER, P., 1879. [Note on *Labidostomma* Kramer.] *Arch. Naturgesch.*, **45** (1), p. 13 (Teste Neave, 1939, Vol. 2, p. 841; see in Southcott, 1961*a*, p. 591).

MEYER, MAGDALENA K. P., and RYKE, P. A. J., 1959. Nine New Species of the Superfamily Erythracoidea (Acarina : Trombidiformes) Associated with Plants in South Africa. Acarologia, **1** (3), pp. 304-23.

OUDEMANS, A. C., 1937. "Kritisch Historisch Overzicht der Acarologie", Vol. III, Band C-G (E. J. Brill: Leiden).

OUDEMANS, A. C., 1941. Neue Funde auf dem Gebiete der Systematik und der Nomenklatur der Acari. VIII. Zool. Anz., **136** (9-10), pp. 177-86.

SAY, T., 1821. An Account of the Arachnides of the United States. J. Acad. Nat. Sci. Philad., **2**, pp. 69-83. (Teste Oudemans, 1937, K.H.O.A. IIIC, p. 952, IIIG, p. 3271.)

SCHENK, E. T., and MCMASTERS, J. H., 1956. "Procedure in Taxonomy". 3rd Ed. (enlarged and in part rewritten by A. M. Keen and S. W. Muller). (Stanford Univ. Press: Stanford.)

SOUTHCOTT, R. V., 1946. On the Family Smaridae (Acarina). Proc. Linn. Soc. N.S.W., **70** (3-4), pp. 173-8.

SOUTHCOTT, R. V., 1960. Notes on the Genus *Sphaerotarsus* (Acarina : Smarididae). Trans. Roy. Soc. S. Aust., **83**, pp. 149-61.

SOUTHCOTT, R. V., 1961*a*. Studies on the Systematics and Biology of the Erythracoidea (Acarina), with a Critical Revision of the Genera and Subfamilies. Aust. J. Zool., **9 (3), pp. 367-610.

SOUTHCOTT, R. V., 1961*b*. Description of Two New Australian Smarididae (Acarina) with Remarks on Chaetotaxy and Geographical Distribution. Trans. Roy. Soc. S. Aust., **85**, pp. 133-153.

WHARTON, G. W., and FULLER, H. S., 1952. A Manual of the Chiggers. The Biology, Classification, Distribution, and Importance to Man of the Larvae of the Family Trombiculidae (Acarina). Mem. Ent. Soc. Washington, Number 4, pp. 1-185.

WOMERSLEY, H., 1934. A Revision of the Trombid and Erythraeid Mites of Australia, with Descriptions of New Genera and Species. Rec. S. Aust. Mus., **5** (2), pp. 179-254.

WOMERSLEY, H., 1936. Additions to the Trombidiid and Erythraeid Acarine Fauna of Australia and New Zealand. J. Linn. Soc. (Zool.), **40** (269), pp. 107-21.

WOMERSLEY, H., and SOUTHCOTT, R. V., 1941. Notes on the Smarididae (Acarina) of Australia and New Zealand. Trans. Roy. Soc. S. Aust., **65** (1), pp. 61-78.

** Contains a full bibliography of the family.